# ELECTRICAL REVIEW

[ILLUSTRATED]

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## ELECTRIC LIGHT, TELEPHONE TELEGRAPH AND SCIENTIFIC PROGRESS.

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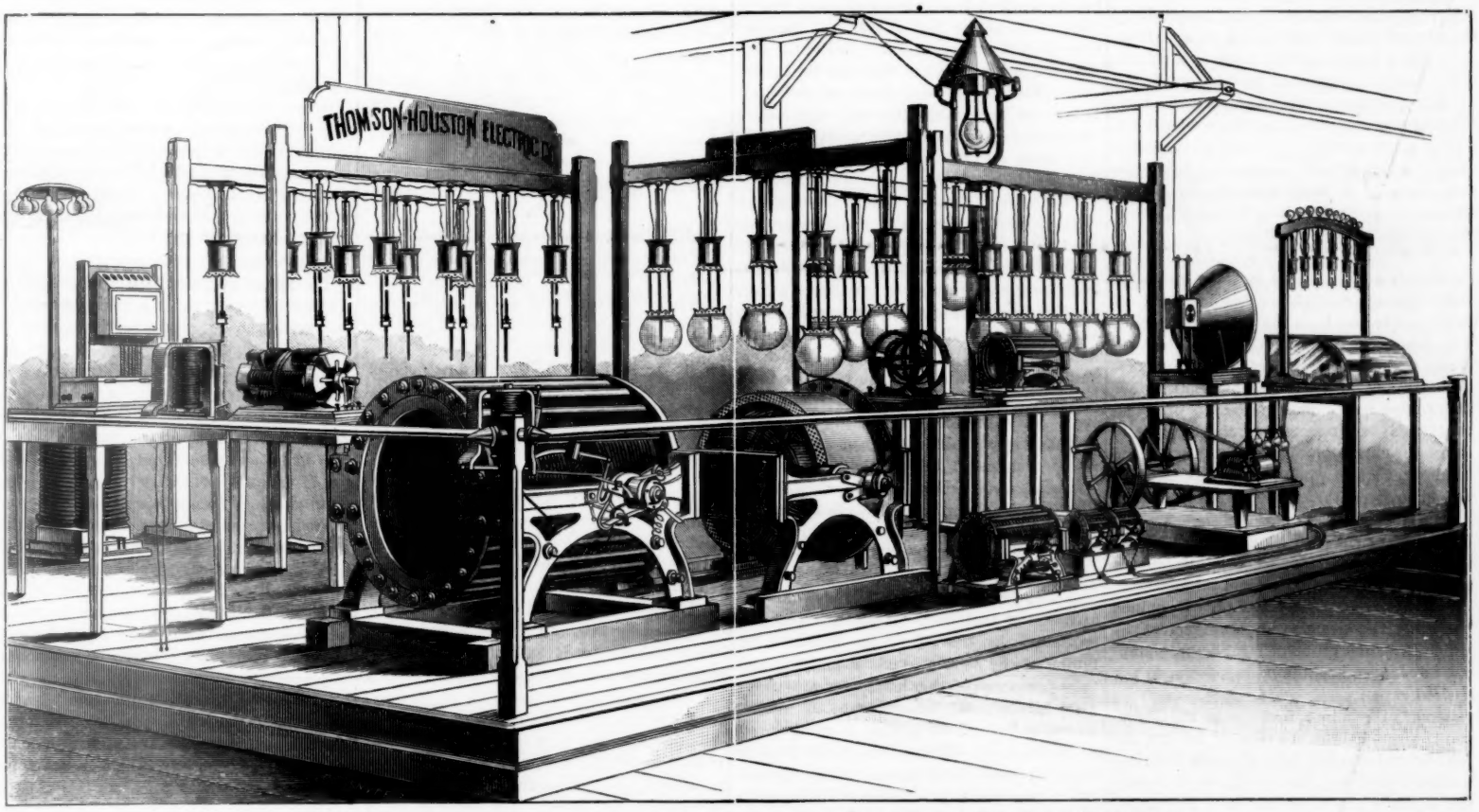
### New Applications of Electrolysis.

Two new applications have been lately reported which seem worthy of further trial. The first is a system of tanning in which the skins are suspended in a tannin bath, which is traversed by an electric current. The skins are at first placed at the negative pole, in order to destroy the nitrogenous matters; after eight days a more concentrated solution is introduced, and the direction of the current is traversed. This is said to oxidize the tannin and to hasten its precipitation in the cells of the hides. In the second application, M. Abadie seeks to recover the tin from the scraps of tinned iron which are so abundant about tinners' shops. He places them in an electrolytic bath formed of a solution of chloride of sodium, with the addition of chlorhydric acid. The anode is metallic, and the tin is deposited upon it in crystals, if the current is intense, or in an amorphous layer when the current is moderate. The rapidity and thickness of the deposit are said to be proportioned to the acidity of the bath.

### Electric Boats.

M. Reckenzaun believes that on boats of moderate dimensions electricity can be advantageously substituted for steam. The motor should always be ready to act, and should occupy the least possible space. The duration of action is of little consequence, since the distances to be traversed are generally small. An electric boat can carry twice as many passengers as a steamboat; consequently, it can be smaller, cheaper and less difficult to drive. Electricity has the additional advantage, especially in pleasure boats, of avoiding smoke, smell, noise, and the inconvenient presence of the boiler. It is not long since a steam canoe, carrying fuel sufficient for seven hours' consumption, was considered a marvel; electric boats already surpass this limit. During the past autumn an electric canoe made numerous voyages on the Danube, under excellent conditions, and there is reason to expect that even ships of considerable size may be finally driven by electricity.

It is very much to be hoped that some one of means in this country will show enough interest in the progress and development of electrical science to construct a small electric launch or canoe, and set it in operation as a matter of experiment. It would not cost a great deal of money, but it would at least serve as a foundation upon which to build.




THE THOMSON-HOUSTON ELECTRIC COMPANY'S EXHIBIT AT THE PHILADELPHIA ELECTRICAL EXHIBITION.

### The Thomson-Houston Electric Company's Exhibit.

The illustration on this page shows the main features of the exhibit made by the Thomson-Houston Electric Company at the International Electrical Exhibition. Although this company does not take up so much room at the Exhibition as some of its competitors, the visitor is struck with the remarkably practical and business-like nature of the Thomson-Houston apparatus. Our readers will recognize at once the large dynamo electric machine, with its automatic regulator, and the arc lamps now so well and favorably known throughout the country. An interesting feature of the exhibit is a dynamo with one field magnet removed, showing fully the spherical armature and its relation to the magnet poles. In the complete machine the armature is so thoroughly enclosed by the hemispherical pole pieces, with their strong framework of iron bars, that this dismantled machine is a welcome addition to the means for instructing the uninitiated in the mysteries of the peculiar Thomson-Houston system. Going still further, the company exhibits a skeleton machine, by which the exact method of winding the field magnets and the armature of the Thomson-Houston dynamo, with the manner of connecting the three branched coil to the commutator segments, is made perfectly clear to any one who cares to give it three minutes' study. This skeleton machine does not contain the iron cores of the complete dynamo, but its armature nevertheless rotates rapidly as a motor when energized by the electric current.

The automatic regulator of the dynamo attracts a large share of attention. It consists of two parts, one of which is a powerful electro-magnet, called the motor magnet, attached to the machine and acting directly on the movable supports of its commutator brushes, while the second part is a double electro-magnet, called the controller magnet, governing a set of circuit contacts by which the flow of current in the motor magnet is regulated. The chief objection to the arc light in the past was its liability to a spasmodic and flickering action. The function of the Thomson-Houston regulator is to control the current so perfectly at its source in the generator that it shall be sensibly constant under the greatest variety of conditions. The operation of the controller magnet at intervals forces current through the motor magnet and at other times diverts the current into another path; and the controller magnet armature is so delicately hung that the slightest tendency to a variation of the main current from its desired normal value causes a change in the relative times of rest and action of the motor magnet, and thus insures that the position of the brushes on the commutator shall always be exactly as required to produce the standard current on the line, no matter whether the dynamo is running one light or any number between one and fifty or more, or no matter what the speed of the dynamo may be, provided, of course, that the speed is not so very low as to be incapable of supplying the minimum energy required. The regulator is perfectly automatic, and lights may be thrown into or out of circuit with perfect freedom, without affecting other lights on the same circuit; but the power consumed depends only on the number of lights actually in use. This complete control and regulation of the current to a fixed standard amount, and the simple and effective mechanism of the Thomson arc lamps, results in the production of a light of great steadiness and beauty; and the Thomson-Houston Company may well be proud of the general verdict of approval of their system given by visitors to the Exhibition.

Several different styles of arc lamps are exhibited by the company, each suited to a particular use. Besides the standard lamp for streets, stores, and general factory use, there are several kinds of ornamental lamps. The lamps are made to burn one set of carbons, or two sets, according to the length of time required in use. The carbon-feed lamp is one which feeds the carbon directly, without employing the ordinary supporting rod. This doing away with the rod allows the lamp to be made shorter than other lamps, and thus provides a lamp adapted for low-studded rooms. The capacity of the different lamps varies from 1,000 to 4,000 candle power per lamp, according to the requirements of any case, the power consumed being, of course, dependent on the candle power.

Focussing lamps with parabolic reflectors, for use as headlights of steamers, form an interesting feature of the display.

A novel method of running arc lights, lately devised by Prof. Thomson, consists in dividing the arc circuit into two or more branches, in each of which arc lights requiring less than the total current are burned; the division of the current being made by introducing into one or more of the branches a large coil of insulated copper wire surrounding a core of soft iron. This acts to prevent sudden changes in the divided current, and thus renders possible the practical use of an electric current for arc lighting in multiple branches, which it is believed has never before been exhibited.

The company shows a complete arc and incandescent lighting plant on a very small scale, two generators producing respectively the arc and incandescent lights being driven by a third small dynamo used as a motor. There is also a compound machine consisting of two armatures on one shaft, one of which armatures is energized from the arc light circuit as a motor, while the other developes a current which is used for running incandescent lamps. A hand dynamo capable of running a small arc light or five or six incandescent lights is also exhibited.

One of the most interesting pieces of apparatus is a distributing box, by means of which groups of eight or ten incandescent lights can be run from the arc light circuit. The Thomson-Houston Company has recently begun the manufacture of these distributors and of incandescent lamps. The distributing box contains a group of resistance coils and magnets arranged so as to throw the current automatically into the incandescent lamps when they are needed for use, or to divert the current through the resistances when the lamps are not needed. The arrangement is such that the arc circuit is never broken. The arc lights are not affected by the distributor, and the incandescent lights receive only the pre-determined current. There is also an arrangement by which the whole group of incandescent lamps can be reduced in illuminating power to any desired extent.

Among the minor features of the Thomson-Houston exhibit are electric motors, automatic and absolute cut-outs, switchboards, hanger boards, etc. In a glass case are shown the separate pieces of the most interesting apparatus. These exhibit the great simplicity and ease of manufacture of the commutator of the dynamo, as well as the interchangeability of its segments, and its perfect insulation. Prof. Thomson's mechanism for producing an air-blast on the commutator is shown in pieces; and its working so as to destroy the spark at the brushes is easily understood.

We ought not to omit mention of a small but very important invention of Professor Thomson's exhibited here. This is a device for protecting dynamo machines in local stations from danger in case of a stroke of lightning following the circuit wires into the station. Two wing-shaped conductors are arranged near together, one connected to the line and the other to the ground, and an electro-magnet is so placed as to rupture any arc between them that may be formed by lightning on the circuit, immediately after the dangerous discharge has been diverted into the earth. It is useless to enlarge on the value of the protection to property, and even life, afforded by this simple device.

The whole Thomson-Houston exhibit has been one well worthy the careful study of every one interested in the use of electric lights.

### Electric Light and Power.

A certificate of incorporation of the "Southern Baxter Electric Light and Power Company of Baltimore City" was filed for record last week with Messrs. Alan P. Smith, Benson M. Greene, William Whitridge, Eli J. Henkle, Geo. N. Torrance, James F. Morrison, and Bradley T. Johnson, as incorporators and directors for the first year. The object of the corporation, as set forth, is the acquiring and selling patent rights relating to electric light and power, and manufacturing machinery to generate and transmit electric light and power. The capital stock is placed at $1,000,000, in 10,000 shares of $100 each.

### The New Plan for Watching and Aiding the Police in their Duties.

It is probable that the police of the Fifteenth Precinct will soon be under electric surveillance, and that a system which was believed to have proved impracticable will be tested, free of expense to the city. Months ago boxes and lines were put up in the streets of the Fifteenth Precinct, and an indicator board, switches, and batteries in the Mercer street station house. But trouble came when it was attempted to put the electrical idea into mechanical shape. Last Spring the indicator board was taken out of the station house and it was said that the scheme was impracticable. Within a few days the indicator board was put up in the station house again, and those interested in the system announced that an expert electrician had mastered all difficulties, and that in a week or ten days a public test of the lines would be given.

The system aims at doing all that the Chicago system does, and avoids what has been criticised as its objectionable features. In the Chicago system many signal boxes are connected on one circuit, so that a break, or other interference at any point renders the whole system useless until the check is removed. Such a system compels the overhauling of the whole circuit until the fault is found. Then, again, in Chicago, the signals are tape-recorded, making necessary deciphering and searching of records to interpret signals. Telephonic systems have hitherto proved useless. The system in the Fifteenth Precinct comprehends a separate wire connection for each of 32 posts or patrols. There is a signal box at each end of each post, and in the station house on the indicator board are 64 indicators—one for each end of each post. Registration of correct duty by the officer on post and the timing of the patrolmen are automatic, and the operations of the indicators are clear. They include calls for assistance and ambulances, so that, if the system is carried out as planned, an officer will seldom have to leave his post. Each box for police signals has a separate key, so that meddling with them by practical jokers or criminals is not easy. The "ambulance" and "assistance" section of the boxes have common keys. Later on a patrol wagon and an ambulance may be kept in readiness at the station house. At present the Police Commissioners have no fund out of which they could pay for the system, and, should they approve of it, they would have to ask for a special appropriation.

### A New Unit.

The practical application of electricity has compelled the introduction of new units of measurement for which names have had to be found. The sponsors have succeeded in finding brief names for them in the names of individuals who are more or less celebrated as physicists. It is a good idea to perpetuate the names and memories of those who have done so much for us, but the practice, if carried further, may have ridiculous consequences. Already they are sufficiently absurd, as in the Watt, which is the result of a volt and an ampere. The tendency to a multiplication of units, upon which we have before remarked, still exists, and we have suggestions continually cropping up for their increase. Among the most wildly absurd of them we may class that made by Mr. W. H. Preece, at the recent meeting of the British Association. The electrical horse-power is 746 Watts; this number does not please Mr. Preece, and he desires to alter it to 1,000, and in order to preserve the co-relation between the electrical and the mechanical horse-power he coolly proposes that the number 33,000 should be changed to 44,236 foot-pounds per minute. Evidently Mr. Preece is a theoretician of the most theoretical order, and utterly ignorant of applied mechanics. We see, however, no valid objection to his proposed unit *per se*. It would be very convenient for electricians, but it must not be called a horse-power, or the equivalent of a horse-power. In honor of its inventor let it be called the Preece. It will be easy to relate it to the actual horse-power thus: The Preece equals 1½-horse-power, that is to say, as nearly as can be calculated, four-donkey power. We have then 250 volt amperes=one-donkey power and four-donkey power=one Preece. The connecting link would be three electrical donkey power=one mechanical horse-power. We have thus introduced, for the sake of compactness, another new unit; following precedent we should give the name of some physicist to it, but unfortunately we cannot think of one worthy of coming into the chain, and will therefore leave the donkey alone. It is awkward; "one Preece=four-donkey power" looks personal, but then 746 Watts=one-horse power, is equally personal; it is one of the penalties that must be paid by genius. We should like to depose the donkey, but regretfully confess our inability.—*Mechanical World.*

### The Boston Electric Protective Association.

A faithful and thorough guardianship of his merchandise and valuables against the operations of thieves, burglars and other enemies, is what every merchant, business man and private individual is most desirous of securing. The elaborate system perfected by the Boston Electric Protective Association has proved so successful in this respect, that it numbers among its patrons nearly 200 subscribers from the heaviest and wealthiest mercantile houses in this city. The central office is at No. 56 Summer street, from which wires extend to the stores of each subscriber, connecting therewith all the doors, windows, skylights, etc., through the clock register (G. W. Adams's patent). In addition to this is the hourly control of picked men conducted by the company, who are compelled to keep up a good record on the dial of the register locked in the store. This register also acts as an indicator in closing the store, so that it is impossible to go away for the night leaving a window or door open. All openings after regular business hours are treated as burglarious, and a reserve force is instantly despatched from the central office to ascertain the cause. The name of every party entering the store is thus reported. This patrol system is a great additional security, as purely mechanical appliances are liable to break down under various circumstances. The patrol, however, is constantly on hand and their work is faithful and prompt. Not from big storms or other causes is the service interrupted, but the communications are constantly kept open. In case of alarms of fire the association ask their customers to remain quietly at home; should they be needed a carriage will call for them at any hour of the night without charge. Daily reports are made to each customer as to the opening and closing of his place of business, giving also the names of parties who may have entered during the night. The advantages of this system are so numerous that a recapitulation of them is unnecessary. In adjusting insurance, great aid is often afforded by a consultation of the company's records. A list of the officers will further establish the high character of the organization in public confidence. They are Weston Lewis, President; Geo. W. Adams, Superintendent; Benjamin F. Dyer, Treasurer; Weston Lewis, Henry W. Wellington, Geo. W. Adams, Benjamin F. Dyer, Directors.

### Electrical Fallacies.

It is strange that intelligent people should be misled by wild statements regarding results attained by inventors of novel electrical apparatus. There is no law of nature more firmly established than that of the conservation of energy, which teaches that in the transmission of power, or the translation of energy from one form to another, the net result *must* exhibit a certain loss, due to friction, absorption, radiation and other causes. Notwithstanding this easily understood fact, fabulous stories are circulated from time to time. These are admitted into the columns of alleged scientific papers, where they acquire additional prominence from the endorsement of supposed experts. Since the introduction of the electric light, the generation of electricity by steam power has become a familiar process to the public, as well as to scientists and electricians. The inventor or promoter of nearly every new lamp or dynamo machine which is brought out, invariably asserts that less power is required to produce a given result than was the case with previous inventions.

The evolution of the storage battery is making similar progress, and in this the margin between the electricity which goes in and that which is subsequently taken out is the real test of efficiency; hence, whatever merit there may be in a new form of secondary battery, will generally be found to be based upon its greater percentage of efficiency.

Generators which produce electricity in effective quantities at a merely nominal cost may generally be looked upon with suspicion, and should their results be out of all proportion to well established scientific formulæ, it is safe to assume that the true inwardness of the experimental exhibition has been carefully concealed.

The use of galvanic batteries for the production of light, and for the generation of motive power, has a peculiar fascination for many investigators, even at the present day, when the use of steam and water power has been conclusively proven to be the most economical method of evolving electricity. As a matter of convenience such a process may be advantageous, but generally speaking, it cannot be otherwise than wasteful, cumbrous, and inconvenient.

Various schemes are set on foot from time to time which have no other object than the fleecing of those who are induced to invest money in them. Scientists and experts are ridiculed for their skepticism, the growth of which has been fostered by the bursting of hundreds of bubbles, practically as visionary as perpetual motion. We regret to say that electricity has been the foundation of many questionable enterprises, owing to the fact that, to some, it appears to be an unfathomable mystery, which may be infinitely developed by ingenious inventors. Upon this basis of popular ignorance, manufacturers and venders of magnetic ointments, electric plasters and galvanic belts, have laid the foundations of vast fortunes. A wide field has been opened for cultivation by adventurers of this class, and the efforts of the press should be directed toward their suppression, rather than encouragement.—*The Electrical Engineer.*

### Binko's Electric Railway.

This railway, formerly laid down at the Crystal Palace, has been in operation at the International Forestry Exhibition in Edinburgh for two months, where it has met with extensive public patronage, besides being honored by a journey taken by the Prince and Princess of Wales and their family, and subsequently by Mr. and Mrs. Gladstone. The length of the line laid down at Edinburgh is about double the length of that at the Crystal Palace, and traverses the length of the exhibition building on the outside

twice, besides making a wide sweep for the turning. The diameter of the turn is forty-five feet only, and the "locomotive," or guiding car, and the passenger cars are constructed specially to take this small radius. The guiding car weighs about two tons, and when the cars are filled the load is six tons. Under the Binko system, one rail serves for the leading and the other for the return current, and a specialty of the invention is that each car is electrically connected with the dynamo, so that, instead of being dead weight, the inventor claims that they furnish their own quota to the motive power. About 30,000 passengers have been carried since working began, the cars used being open, and constructed to carry more than a dozen passengers each. For the visit of the Prince and Princess of Wales a sumptuous car was built by Mr. Hislop, coach builder, Edinburgh. It was richly upholstered in silk plush of the royal scarlet, while the sides and roof were elegantly decorated. In the center of the roof a brilliant prismatic lamp was placed, lit within by electricity, while four small incandescent lamps, within drop shades of convolvulus shape, were placed at the ends. The light here was supplied by secondary batteries, or "accumulators;" and by an ingenious arrangement a beautiful bouquet on the center table was lighted up by miniature lamps on a button being pressed. After the royal party had used the car, and expressed their interest in the journey, the car was laid aside until Mr. Gladstone's visit, and, as already stated, the Prime Minister made the journey, which he enjoyed very much. The motive force for the line is provided by an eight horse-power engine.

### American Electric Construction and Supply Company.

The American Electric Construction and Supply Company have met with unusual success since its commencement. The company intend to enlarge their premises next year. They combine the construction of electrical apparatus of all kinds with the general supply business. The construction department is under the immediate charge of Mr. A. Kitson, formerly of the Telegraph Construction and Maintenance Company, of England, and recently superintendent of the United States Electric Light Company, of Pennsylvania; while the electrical testing and repair department is under the superintendency of Mr. H. G. Rees, formerly connected with the Police and Fire Alarm Department of Philadelphia. The repair department is a special feature with this company. All systems of electric light plants are here repaired and put in good working order. They have an improved apparatus for winding armatures which greatly facilitates this branch of the work, and materially reduces its cost. A new switchboard, specially adapted for electric lighting stations, has been designed by Mr. Rees. Several of them are now in use by lighting companies throughout the State. It is easily operated, and admits of coupling up of two or more circuits to one machine. It consists of two rows of springs of special design, and two rows of plugs. The upper springs are connected with the positive poles of the machine, and the lower to the negative poles, the plugs being connected to the lines. A lower row of springs, each being connected to the positive line wire, permits of the joining of any number of circuits in one. A combination of changes may be effected almost instantancously. The company are the sole agents for the Van Depoele Electric Lighting System, of Chicago, for the States of Pennsylvania, New Jersey, Delaware, Maryland, and District of Columbia. The President, Mr. D. H. Levett, who has charge of the financial and business department, has been for some time very largely connected with the electric lighting interests, and is well known throughout the State. Mr. Hane, the secretary, takes charge of the foreign business.

Statistics prove that the average number of words in telegraphic dispatches in America is fourteen words per telegram. It should be stated, however, that this is only true of dispatches sent during the day-time, as the average is higher for telegrams sent during the night at reduced rates.

### Description of the Electric Railway in Operation at the Toronto, Canada, Exposition, as Constructed and Operated by Chas. J. Van Depoele, Electrician of the Van Depoele Electric Light Company, Chicago.

The locomotive car containing the electric motor and appliances weighs about seven tons, and occupies a space of 6x14 feet. The motor is of the type of the Standard dynamos, manufactured by the Van Depoele Electric Light Company, of Chicago, Ill., and the power available is about 30 horse-power. The electric current is generated in the machinery hall building, where a steam engine is running a 40 horse-power generator of the same type as the motor. The current from said generator is conveyed by means of two copper conductors from the generator to two flat copper strips running the whole length of the track, some 2,000 feet. These copper strips are carried in a base made of well-seasoned lumber thoroughly permeated with insulated gums. The insulation leaves nothing to be desired. Upon these two strips two brushes are traveling with the car, carrying the current to the switches and motor. The whole arrangement is complete in every detail. The cars can be run back and forward with perfect ease, and fast or slow as desired. The track, as above stated, is some 2,000 feet in length, and has for a distance of 1,000 feet an incline of from $\frac{1}{8}$ to $\frac{5}{16}$ inch to the foot; there are also four curves; the track is straight and level at each end. As at present the motor car pulls three cars each of three tons weight empty; each car can carry 60 people or more. With the power at command the number of passengers could be more than doubled. For experiment the train has often been stopped on the middle of the incline, but the moment the current was applied to the motor the train moved upward with wonderful rapidity, showing that the power is ample, and the scheme a perfect success.

The electrical railway has proved a perfect success, and there can be no doubt but what electrical railways will eventually be permanently adopted in most places where street railways are now in use, as well as other short lines of street railway between cities, etc.

The Van Depoele Electric Light Company of Chicago, Illinois, have several patents in the United States upon this system of electrical railways, and upon motors for the same, and are now getting ready to put in electrical railways in several places in the States. The company have an exhibit of their system of lighting, and motors, at the electrical exhibition in Philadelphia.

### Primary Batteries and Electric Lighting.

In a recent lecture delivered in the hall of the Society of Arts, Mr. J. Probert entered into the relative cost of dynamo and battery lighting. He took as the basis of his calculation a house lighted by 100 incandescent lamps, each requiring $\frac{3}{4}$ ampere and an electromotive force of 100 volts. Each lamp would therefore require 75 watts, and the whole 7,500 watts, or 10.05 horse power. Supposing the dynamo to have a commercial efficiency of 80 per cent., then the actual horse power required would be $10.05 + 1.25 = 12.55$ horse-power. A horse-power requires in the steam engine a consumption of, say, $4\frac{1}{2}$ pounds of coal per hour. Therefore $56\frac{1}{2}$ pounds of coal would be required to generate the 12.55 horse-power, and this would cost 6d. Assuming that the lamps were required to burn 1,800 hours a year, or five hours a day, the annual cost of coal would be £45. The prime cost of a suitable dynamo and engine, with boiler, would be, say £300, the interest on which, at 4 per cent, would be £12, and the annual depreciation would be 10 per cent., or £30. The cost of attendance would be £60, so that the prime cost would be £300, and the total annual cost £147, or £1 9s. 5d. per lamp.

On the other hand, with the voltaic battery the energy would require to be produced at a rate between 10.05 and 20.1 horse-power, since its efficiency depends on the ratio between the internal and external resistance of the circuit. Supposing the ratio to be such that the efficiency is 80 per cent. To liberate a horse-power of energy a quantity of zinc must be oxydized equal to 2.022 lbs. divided by the electromotive force of a single cell. The highest electromotive force obtainable in a zinc sulphuric acid battery is 2.248 volts, but from this must be taken the energy absorbed in depolarization. The amount of reduction depends on the nature of the depolarizer; with nitrate of soda and sulphuric acid it is .708 volt; with bichromate of potash it is .343 volt; with fuming nitric acid it is .284 volt. Assuming that the latter is the depolarizer the net electromotive force would be 1.964 volts, and this corresponds, by the above rule, to a consumption of 1.03 lb. of zinc per horse-power-hour of energy. To liberate 12.55 horse-power-hours, 12.93 lbs. (say 13 lbs.) of zinc must be used. If the price of zinc be taken at $2\frac{1}{2}$d. per pound, the zinc used per hour costs 2s. $8\frac{1}{4}$d.; but the expense does not end here. Sulphuric acid, the usual oxydant of zinc, costs $\frac{3}{4}$d. per pound. To oxydize a pound of zinc $1\frac{1}{2}$ lbs. of sulphuric acid is required ($Zn + H_2SO_4 = ZnSO_4 + H_2$). To oxydize 13 lbs. of zinc requires $19\frac{1}{2}$ lbs. of acid, and this costs 1s. $2\frac{5}{8}$d. This, added to the cost of zinc, makes 3s. 11d. To give the best return the electromotive force must be high, and if we suppose the nitric acid produces $N_2O_2$, the amount of acid required is shown by the equation $2HNO_3 + 3H_2$ (equivalent to $3Zn) = N_2O_2 + 4H_2O$. It follows that the solution of every pound of zinc is accompanied by the deoxydation of $\frac{2}{3}$ lb. of nitric acid. In the production of 12.55 horse-power-hours of energy, $8\frac{2}{3}$ lbs. of nitric acid will be deoxydized, the cost of which, at 6d. per pound is 4s. 4d. This, added to the cost of zinc and sulphuric acid, gives 8s. 3d. as the total cost of materials. Neglecting the waste due to scrap zinc and partially spent solutions, this rate, for 1,800 hours per year, amounts to £742 10s. for cost of materials only. The prime cost of the battery would be £120, the interest on which, at 4 per cent. is £5 and the annnal depreciation at 10 per cent. is £12. Neglecting cost for attendance, we get a total of £759 10s., or at the rate of £7 11s. 8d. per lamp, as against £1 9s. 5d. for dynamos.

Mr. Probert concludes rightly enough from these figures that for a large installation batteries are out of the question as compared with dynamos, at least until they are greatly improved; but for small installations, where dynamos are unsuitable (and there are many openings for such), the battery has a future before it. The use of lead or iron in place of zinc, or some cheaper oxydant than sulphuric acid, may considerably reduce their cost; and the utilizing of waste products, a subject which Mr. Probert passed over as of little moment, may effect a still further economy. "It may be interesting to notice," said Mr. Probert, "that in the telegraph department of the Post Office no residues are thought worth preserving except the 'black mud' (technically so-called) from the Daniells, which contains a very large percentage of pure copper in the metallic state. Last year there were 69,323 Daniell cells in use, and the sum realized by the sale of the year's 'black mud' was £167 14s., or rather more than $\frac{1}{2}$d. per cell per year. An idea may be formed from these figures of the magnitude of the sum likely to result from the sale of the zinc residues—which, in the Post Office, are thrown away as worthless—in the case of an ordinary householder using some ten or twenty cells."

Indeed, if we are to go by the results of the Post-Office in this matter, the return from waste materials in batteries for electric lighting would be very small, and probably the plan adopted of throwing them away as worthless would be adopted. The German Imperial Telegraph Department acts on a different system, and sells the waste material on far more favorable terms, for according to figures recently published by us (see *Engineering*, Vol. XXXV., page 566) the department recovered no less than 22 per cent. of the cost of materials consumed in their batteries. During the year 1881-2 Mr. Kolb tells us that £12,350 were spent on the 127,166 cells in use in Germany, and £2,727, or about 22 per cent., was recovered by the sale of battery residues, consisting of lead, copper and zinc salts. As compared with the insignificant sum realized by our own Post-Office, the difference is very striking. The normal cell in the German telegraph service is also a form of Daniell, and we are therefore forced to conclude that it is by properly saving up, instead of throwing away, the zinc solutions and other materials, as well as the copper "mud," and disposing of these in a proper market, that the striking difference exists. English chemists can utilize these waste products as well as German ones, if the matter were brought before them.

It will then be seen that Mr. Probert has been unfortunate in his example of the return to be expected from waste products. Moreover, he has apparently overlooked two very important factors in the problem. He has overlooked the fact that electric light batteries, working at a high pressure, so to speak, and supplying powerful currents, consume much more materials than telegraph batteries, sending comparatively feeble currents through a high external resistance, and working intermittently. His own figures may be brought forward to show how much the waste of materials in a lighting battery is.

Suppose, for example, that 22 per cent. of the £759 10s. expended in his battery for 100 lights were obtained for waste products, the sum would be £167, which is almost the exact figure realized by the "black mud" of the whole 69,323 cells of the Post Office. And this estimate of 23 per cent. is not too high for other batteries than Daniell's if their solutions are properly utilized. For some electric light batteries now in the field it is much too low. We are acquainted with one which, in a chemist's hands, returns much more than 22 per cent. of the original cost of materials. This brings us to the other matter overlooked by Mr. Probert, namely, the utilization of the depolarizing solution, as well as the oxidant solution, and also the gases liberated. For example, in the Holmes-Burke battery, the nitrous gas can be utilized by forming nitrate of ammonia solution with it. Indeed, the whole matter is in its early stages, and there is ample room for enterprise in the chemical utilization of waste battery products. When the matter has been properly studied, as it will be, if batteries are used for lighting, it is very possible that a considerable percentage of the cost of materials will be returned from the utilization of the waste materials. At one time the residuals from gas manufacture presented a more hopeless problem.—*Engineering.*

### Electricity and Locomotion.

The firm of O. Steinbeis, of Rosenheim, Bavaria, has introduced an electric railway in the place of the tramway on which the timber to be cut had hitherto been conveyed to the saw-mill. The necessary electric current is supplied by the extensive water-power connected with the works. The locomotive consists of an ordinary vehicle furnished with a platform; on one side of it there is a second electro-dynamic machine, on the other a mechanism by means of which the great rotary speed is reduced within certain limits. Only one attendant is required to mind the locomotive and the two carriages appended to it. The engine is capable of dragging a a load of six tons at a speed of 137 feet 9 inches per minute—which is a very favorable result, seeing that there are a great many curves on this line. In the evening, when there is no traffic on the railway, the electric current is used very profitably, and without involving any additional expense, for lighting the whole of the mill, both inside and out; the extensive water power is then made use of in the usual way. The question arises whether it would not be possible to produce electric force and light in the same way in other places in which there is a superabundance of hydraulic power.

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We note that, in the report of the Western Union Telegraph Company, it is stated that none of the company's telephone stock has been sold, inasmuch as the price offered did not seem enough in view of its dividend-earning power. The Western Union directors evidently believe that the telephone business has a future which the public does not fully appreciate.

The bottom of the sea is now so covered with cables that grappling for lost and broken cables is very apt to result in pulling up sound ones. It is believed that something of this kind caused the recent break in the two Gould cables, which is located just about where the Faraday is known to have been at work fishing for the Mackay-Bennett cable. There are now six cables in working order.

There seems to be reason to suppose that the decision in the Bell-Drawbaugh suit may not be so long delayed as we had feared. The judge, by his remarks to counsel, gave proof of familiarity with the evidence, and, if he has mastered that, a long step has been taken towards a solution of the question before him. It is also to be noted that there is nothing in the nature of an interference of two patents to be decided. It is simply a question of priority—a matter of dates, and nothing else. It is certainly to be hoped that this view may prove correct, for "enterprises of great faith and moment" await the determination of this important question.

The Electrical Exhibition closes its doors this week. It has been a success as an exhibition and as a money-making enterprise, and, if it has not been all that fancy painted it, it is just possible that fancy may have painted it in colors a trifle too glowing. It has had its "outs," of course, and some of them have caused disappointment, but, taken as a whole, it has been a benefit to the electrical fraternity and to the public, and both are indebted to the Franklin Institute for its enterprise in planning the exhibition and carrying it on to a successful issue. It has been rewarded for its courage and endeavor, for, besides the building, which is paid for out of the proceeds, quite a handsome sum in money remains to it as profit.

The annual report of the Western Union, presented to the stockholders on Monday, which covers the year from July 1st, 1883, to the same date in 1884, gives proof of what we have said concerning the telegraph business of the country. Although it has been a year of depression in business, although it included the period of the great strike, which, it is estimated, did not cost the company less than a round million of dollars, and although within the twelve months named, competition has been active and low rates have ruled, the regular dividends of seven per cent. per annum have been paid, a large amount of construction work has been done, and the surplus has increased more than half a million dollars. This is certainly a most gratifying showing, and results from one thing only—the constant increase of the telegraph business of the country—an increase which is normal and natural, and grows out of the constantly increasing habit among business men of using the wire in their business operations whenever speedy communication and a prompt answer are desired. It is true that the directors advise a reduction of the dividend from seven to six per cent., but this is in view of extensive new work that is to be undertaken, and the possibility that certain telegraph properties which it is desirable to purchase may come into the market at reasonable figures. We suspect also that the probability that a good deal of underground work is likely to be necessary has something to do with this conservative recommendation. Even at the figure proposed, Western Union, at present market rates, would be very nearly at a ten per cent. investment.

It is wonderful how little is really known of the effect of electricity on health, and the methods in which it can be used as a remedial agent. It is safe to say that anything which will do injury to the human system if improperly used, can be so used as to do good. Arsenic, opium, and other poisons are familiar examples of this. We know that electricity can be so used as to do the greatest harm, and we know also that in certain cases it has been used with marked benefit as a curative agent; but this has been in a haphazard rather than in a methodical way, and there is a degree of uncertainty as to results and a limitation as to diseases in which it has been known or is even supposed to be useful, that makes one feel that it is a field as yet but little explored. For a long time its use as a curative agent was chiefly in the hands of men unskilled in medicine, by whom it was used with varying success and according to no established rules. It is gratifying to know that men of learning and ability are now more generally turning their attention to it, and that it is in a fair way to be studied and experimented with until some definite and tangible results are arrived at. As one writer has expressed it, electricity is not life, but in many of its actions it so closely resembles what is called nerve force, that it would seem to be nearly related and allied to it. This being the case, it is not surprising that, being properly applied, it may serve an excellent purpose by reaching the system through the nerve centers. But what sort of a current, what strength, what volume, and where to apply it under the varying conditions of disease—these are the questions that only study and experience can determine.

People over here cannot understand why it is that Bell telephone stock has taken such a jump, and more than one has intimated that it was fully his intention to "get aboard" before the rise came. They can't see any reason for the rise, and they don't understand it. The fact probably is that certain parties watched the bearing pretty carefully, and made up their minds then and there what the result would be. They have evidently backed their opinion with their money by giving orders to buy, and the result is seen in the figures. Considering how little stock came out in the rise, it is easy to conjecture where the stock would go to in the event of a favorable decision. Everybody would want to buy and nobody would want to sell, and the price would go so fast no one could follow it.

The indications are that we are to have another telephone suit—one that will open up a good deal of valuable information. It seems that Mr. Frank Hume, a merchant, of Washington; Mr. L. G. Hine, a lawyer, of the same city, and several New York parties, associated themselves together as the Rogers Secret Telephone Company, purchasing their patents of the inventor, Mr. Rogers. They now allege that Mr. Rogers, in selling a batch of patents to the Pan Electric Telephone Company, included several things which he had already disposed of to them, thus deceiving the Pan Electric folks and injuring the Secret Telephone Company. In the meantime the interests of Messrs. Hume, Hine, and their associates, have been sold out to the National Improved Telephone Company of Louisiana, which publishes the following "caution" in the New York *Herald* and *Times*:

"Having been informed that the "Clay Commercial," "Pan Electric," and "Overland" Telephone Companies are using and offering for use telephonic instruments that infringe the patents belonging to this company, notice is hereby given that any party or parties using any of the said instruments that infringe the patents of this company will be prosecuted according to law.

"The Nat. Imp. Tel. Co. of La."

Here, then, is a capital chance for a suit, and an investigation which will determine the respective claims of these several telephone companies. It is but fair to say that the Pan Electric Companies include among their leading managers several gentlemen of very high standing, who, as it seems to us, must have been greatly deceived as to the value of what they have bought.

## Notes at the Exhibition.

On Saturday of this week the Exhibition comes to an end. There was a good deal of talk at one time of keeping it open two weeks beyond that date, and it was semi-officially stated that this was to be done, but the decree has gone forth, and after this week is over the voice of the great organ will be hushed, the splash of the fountain will be stilled, and the whirr of the armatures will be over. I find none that are especially sorry, and many that are very glad, for, interesting as the exhibition is, it has become a trifle tiresome to exhibitors.

Many of the more important exhibits will be packed up only to be shipped at once to New Orleans, where they will be shown in the great Southern International Exhibition which will, it is said, rival the Centennial in extent and importance. The previous showing of these exhibits here will bring one advantage there, they are all ready and can surely be set up and made ready for inspection on the opening day.

One thing has been made painfully evident here—the mistake of putting heavy machinery in motion into a frame building in which delicate machinery is also exhibited. It would have been far better, if they had to have the "annex," to put all the engines and dynamos there, and then bring the currents over into the main building by means of wires. It would have avoided the constant jar, which not only affects all the lights and all other delicate apparatus unfavorably, but is also a sore trial to human nerves. A steady shaking up for six or eight hours leaves people in a very unsteady and uncomfortable position.

They are at work this week testing engines and dynamos by means of dynamometers. The results will not be given out for some time, not until they have all been carefully computed and tabulated. This is a very important and valuable work, and will tend greatly to set at rest the claims made by some inventors, and perhaps bring modest merit to the front. It is to be hoped that there will be no unreasonable delay in getting at the figures.

I have just seen a dynamo of a new type, new in this country, at least, although they tell me that something of the kind has been mentioned in English prints. It is intended especially for electrotyping and plating, and its current, large in volume, is of very low electro-motive force. There is a large bar of iron inside of an iron tube, and in the annular space between a copper tube revolves. There is no wire, no commutator, properly so called, but the positive and negative currents are taken off at opposite ends of the copper tube by means of brushes. The field magnets, which are iron tubes, are wound with strips of copper six inches wide, insulated from contact by means of strips of cotton cloth. The dynamo shown is the only one yet made, and is of course an experimental affair, but has given very satisfactory results, and is to be subjected to thorough tests. It is the invention of Mr. A. Floyd Delafield, of Noroton, Conn.

The storage batteries have not attracted half as much attention here as one might reasonably have expected. The Brush battery is represented and is doing good work, but how economically I do not know. The same exactly may be said of the Faure-Sellon accumulators, which are, however, shown in more portable form. It is very certain that the storage battery as made and used to-day leaves much to be desired, but that is no good reason for saying that there is nothing in it. There is the germ of a good deal in it, and there is every possible reason to suppose that at some day, not very distant, let us hope, it will be so improved as to come into general use. It is in an embryotic state, as yet, but the idea is there. One of these days somebody is going to stumble on the very thing that will obviate the difficulties that now surround it and limit its use, and then everybody will be ready to sound its praises. There are plenty of us who can remember when the daguerreotype was the only sun picture we had, when the "subject" had to sit in the bright sunlight for fully three minutes to have his picture taken, and when the result, even at its best, was shadowy and unsatisfactory. And I can remember when people said that the idea of taking pictures on anything but a metal plate was preposterous, and gave their reasons, good, solid, scientific reasons, as they thought, for their assertions. And I remember that just about that time we got the ambrotype, and then the photograph, and from that day to this the art has gone on improving, until we have reached the stage where we make a picture in the thousandth part of a second, and fasten upon the paper the successive stages of motions so rapid that the human eye cannot follow them. And so, to return, I have faith to believe that, given a basic idea, like that upon which the storage battery is founded, some one is sure to work it out to practical success.

It is interesting to pass an hour in the room in which is displayed the historical collection, chiefly models, in a more or less imperfect state of preservation, from the Patent Office. One is struck with the characteristics which they present. Some, generally the least important ones, give evidence of having been made with great skill and nicety, while others are excessively crude and cheap in the construction, the idea evidently being to convey an idea and illustrate an idea rather than to make an attrac-

tive model. One sees here the germ of many an idea that has since taken practical shape, and likewise many evidences of well-meant but ill-directed endeavor, and consequent disappointment.

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The young Philadelphians of both sexes continue to be a nuisance throughout the day. They come early, bring their lunches with them, and put in a full day. At first they wander about in a harmless sort of way, but when they take to playing tag, dodging in and out among the exhibits, it becomes a trifle annoying to the exhibitor and visitor, without particularly benefiting anybody. I believe admittance costs them only fifteen cents, and they certainly get their money's worth of fun if not of instruction.

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Curious as it may seem, there are some exhibits that are only just now in place and ready for inspection. They are not specially important, but it does seems as though, if they were coming at all, they might have put in an earlier appearance.

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Rumors are floating about to the effect that the Overland Telephone Company, which has an exchange in this city, finds itself rather cramped for funds, and without the means of increasing its plant to a paying basis, even if it could get the necessary number of subscribers. Another obstacle is the unwillingness of the city authorities to permit the putting up of any more wires, in view of the ordinance which requires everything to go under ground next January. The local Bell company has a very large plant, and I am told that its service has improved greatly of late, so that it is giving excellent satisfaction. By the way, I understand that the Bell people here claim to have some vested rights with which no ordinance can interfere, and that their poles and wires will not be taken down without finding out what the courts think of the action of the city government. A great deal of litigation seems likely to grow out of hasty and ill-advised legislation concerning overhead wires, here as well as elsewhere.

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As the end draws near, the attendance, especially in the evening, increases, and there is sure to be a big jam on the closing night, which will be pleasant for the Franklin Institute but trying for the crowd. In the daytime, even in this last week, the attendance is so slim that very many of the exhibitors do not think it worth while to be present.

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Messrs. Holmes, Booth & Haydens have at the exhibition in Philadelphia a complete assortment of their well-known insulated and other wires for all sorts of electrical purposes, very neatly and attractively arrayed. It includes all ordinary sizes of wire, with this firm's well-known patent insulation. Wire of this manufacture is very largely used for electric light purposes, and has an excellent reputation on account of the beauty of finish, and the absolutely waterproof character of the insulation.

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The Brush Company have an excellent exhibit of their well-known system, and its arrangement reflects much credit upon its designers Col. Montgomery and Mr. Curtiss. It has two furnished rooms, a parlor and bedroom beautifully fitted up, and supplied with incandescent lights from a storage battery. In its open space it shows its well-known arc light, and also a number of incandescent lights running from a low tension dynamo of a new pattern. These lights are run in such a way that one or all can be turned on at will, there being no need of any resistance box of regulating apparatus other than that which is on the dynamo itself. This company also shows an armature separate from the balance of its dynamo, in order to show the method of winding, and a special dynamo as applied to electro-plating. It has a number of lights in the building, but these are too extensively used throughout the country and too well known generally to need any special description. The company may fairly be said to have limited itself to a business exhibit, and has done very little in the fancy line, and still less for mere display.

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I am told that the proposed Electrical Exhibition in Boston is surely to open November 24th, and that quite a number of the exhibitors here will show there. I am very glad to learn of the fact, and trust that the enterprise may be carried out to a successful issue. It is very certain that instruction in matters electrical is sorely needed, and I know of no place where it can do more good than in Boston, for nowhere, certainly, are there more people eager to learn and to profit by what they learn than there. They tell me that in Boston all the engines and dynamos are to be put into the basement, and that belting will not be connected with the building itself, so that the jar which is so objectionable here, will be avoided.

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The American Institute of Electrical Engineers has been in session here this week. Some very interesting papers have been presented and read, but the attendance has been small. Mr. Keith, the secretary, has done his best, but it has been hard to get the men together and harder still to keep them together for any length of time.

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Mr. Van Depoele makes an interesting exhibit of his inventions here, including dynamos, lamps and motors, all of which are familiar to those interested in electrical matters. He has also a combined motor and low tension dynamo which is both interesting and useful. He connects the motor into an arc light circuit, thereby getting motion without in any way interrupting the arc circuits. The motor now operates the low tension dynamo, which gives off just the current wanted for a local installation of incandescent lights. I understand that the system has been very successfully tried in the West, and gave great satisfaction. I also learn that Chicago is at last to have extensive arc-lighting from a central station, the wires to be carried underground. It may do well in the densely built portions of the city, where a large number of lights are wanted within comparatively narrow limits, but I have no faith to believe that any underground system can be devised cheap enough to carry the current any considerable distance, as is now done in all of our cities, for the supply of a few lights.

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The Wisconsin Telephone Company has ordered eighty-five miles of No. 12 hard drawn copper wire from the Palmer Wire Company, for a copper line from Milwaukee to Madison. I also learn that the Sunset Telephone Company of California have ordered some fifty miles of No. 14 hard-drawn copper wire from the same manufacturers for long-line use.

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## Mr. Edison to Devote Five Years to the Elimination of the Steam Engine.

Mr. Edison was quite recently asked what progress he was making toward obtaining electricity direct from the combustion of coal, instead of having to get it by first producing heat, then by heat steam-power, and finally electricity from the steam power. The combustion of zinc in a battery is one instance of the utilization of combustion in the shape of electricity, instead of in the shape of heat as when coal is burned. The zinc in the battery is as completely burned up in the battery as is the coal in the furnace; in one case electricity is obtained, in the other heat. Mr. Edison confessed that he could not yet see the end of the search he is engaged in.

"Some day some one will get at it," said he, "and do the world the greatest material service yet rendered unto man. We now get out of coal about one-hundredth part of the real power we ought to get. The great secret of doing away with the intermediary furnaces, boilers, steam engines, and dynamos will be found, probably within ten years. I have been working away at it for some months and have got to the point where an apparently insurmountable obstacle confronts me. Working at the problem now seems to me very much like driving a ship straight for the face of a precipice, and when you come to grief picking yourself up and trying it again to-morrow. There is an opening in the barrier somewhere, and some lucky man will find it. I have got far enough to know that the thing is possible. I can get quite a current now directly from the combustion of fuel. Jablochkoff tried his hand at the same thing some years ago, and so did some Germans; but the results were laboratory curiosities only. I give myself five years to work at it, and shall think myself lucky if I succeed in that time.

"The unscientific world has no idea of what such a discovery would mean. It would put an end to boilers and steam engines; it would make power about one-tenth the cost that it is now; it would enable a steamship to cross the Atlantic at a nominal cost; it would enable every poor man to run his own carriage; it would revolutionize the industrial world. The electric motor is the ideal motor for all kinds of work. What we want is some means of producing the current cheaply. Now it costs ten times as much as it ought to. When we discover the short cut from the combustion of coal directly to electricity we can heat and light houses, do all the cooking, move all kinds of machinery, vehicles, and boats—do all the world's work, in fact, for almost nothing compared to what it now costs us. There is a good time coming for somebody."

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## Sources of Electricity.—Chemical Action.

In any voltaic battery the direction in which the current that is produced flows can always be readily ascertained by the following simple principle, viz., the direction of the current within the battery is always from the metal or element that is the most acted on, toward the metal or element that is least acted on. Outside the battery the current, of course, flows from the metal least acted on to the metal most acted on. Take, for example, the case of the zinc-carbon battery, in which the electrolyte is dilute sulphuric acid or hydrogen sulphate. In this cell the zinc is acted on by the hydrogen sulphate replacing the hydrogen and forming zinc sulphate. The current, therefore, flows from the zinc plate, through the liquid to the carbon; while out of the cell, the current flows from the carbon to the zinc.

It will be observed, therefore, that the polarity of the simple voltaic cell is necessarily different outside the liquid than it is within it, and that, therefore, the current flows out of the carbon pole of the battery and into the zinc pole.

The path of the electric current from the battery through the various electro-receptive devices, such as telegraphic instruments, telephones, etc., etc., and back again to the battery, is called the electric circuit. As soon as the circuit of a battery is *completed*, *made*, or *closed*, as it is technically termed, all electrical manifestations the current is capable of producing are instantly produced or set into operation; on the other hand, as soon as the circuit is *opened*, or *broken*, by breaking the continuity of the conducting path of the current, all electrical manifestations depending on the flow of the current instantly cease.

As we have already pointed out, many different elements, or pairs of metallic substances, are employed for battery plates. Those in most general use, however, are zinc-carbon, platinum-zinc, silver-zinc.

Of the exciting liquids or electrolytes there are also a variety. The commonest are various acid substances, such as sulphuric or nitric acid, or solutions of different metallic salts.

Voltaic batteries, though of a great variety of forms, can be conveniently divided into two great classes, viz., single-fluid and double-fluid batteries. As the name indicates, in the former a single chemical substance is employed as the exciting liquid; while in the latter two distinct and different liquids are employed. In all double-fluid batteries one of the elements dips into one of the exciting liquids, and the other element into the other liquid. The liquids are prevented from mixing with each other either by means of a porous cell of unglazed earthenware, or they are kept apart through differences in their densities.

If we dip a plate of ordinary zinc in dilute hydrogen sulphate we will at once notice that a brisk evolution of hydrogen gas takes place from the zinc plate, and that the temperature of the liquid becomes sensibly higher. If now a copper plate be dipped into the liquid, and care be taken that it does not touch the zinc plate, no change will be observed in the phenomena. The hydrogen will continue to pass off from the zinc plate, and the liquid will remain at a temperature above the normal. If, however, the ends of the plates that project from the liquid be joined by any good electrical conducting material, an entire change will be observed in the phenomena. The hydrogen gas will now pass off from the surface of the copper, and no sensible elevation of temperature will occur.

What now is the explanation of these very interesting phenomena? The source of the energy which appeared as heat when the battery's circuit was opened is already traceable to the energy given out during the fall of the zinc atoms towards the radical $SO_4$, of the hydrogen sulphate. If then, when the battery circuit is closed, this energy is no longer sensible as heat, we can readily see that it should appear elsewhere, and that in point of fact the electric current, which now flows through the battery circuit, is the result of the energy evolved by the combination of the atoms of the zinc with the free bond of the radical $SO_4$.

Since in all single-fluid batteries, in which hydrogen sulphate or sulphuric acid is the exciting liquid, free or gaseous hydrogen is evolved at the surface of the negative element, there must always be a loss of economy, or, in other words, the energy produced by the chemical action of the $SO_4$ on the zinc produces less electrical energy than it might be caused to produce. The reason for this lies in the fact that more energy is required to be charged on matter in order to maintain it in the gaseous state than in the state of a liquid or of a gas. The escape of the hydrogen is therefore a source of loss, and this is the reason why double-fluid batteries are generally much more economical than those with single fluids, since in every double-fluid battery the liquid that surrounds the negative plate is capable of entering into combination with the hydrogen that would otherwise escape from the surface of this plate. This combination, it is useless to add, liberates additional energy as electrical energy.

Suppose, for example, that in a zinc-carbon couple the carbon was dipped into nitric acid. In this case, the hydrogen would enter into combination with part of the oxygen of the nitric acid, and thus give up part of its energy of combination to the circuit as electrical energy.

In some double-fluid batteries a solid takes the place of the second fluid. This is notably the case in the Leclanche battery, in which the carbon is surrounded by a powdered solid, called black oxide of manganese. This solid, however, plays the part of the second liquid, since hydrogen that would otherwise be evolved from the carbon enters into combination with part of the oxygen of the black oxide of manganese.—*The Bulletin.*

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.... As a feat in telegraphy (says the *Melbourne Herald* of the 1st August) the shortness of the time occupied in the transmission of Reuter's telegrams announcing the result of the Goodwood Cup, run in England yesterday, may be mentioned. The race was run at three o'clock in the afternoon, Greenwich time, and the telegram was dispatched from London at 3:17 P.M. It reached the office here at 2:50 A.M., Melbourne time, and was published in this morning's papers. Allowing the 9 hours 40 minutes which Greenwich is behind Melbourne in point of time, this makes the actual time occupied in transmission from one end of the world to the other, 1 hour 53 minutes. This message probably came through more quickly than any message previously transmitted either way, and is regarded as the "best on record." The message sent by the Marquis of Normanby to the Queen and Prince of Wales, announcing the opening of the Melbourne International Exhibition, occupied about three hours longer in actual transmission.

## Telephonic News

*** The favorable conditions accorded to the telephone companies in England, by the British post-office administration, will probably have for consequence a great extension of telephones in England. The introduction of telephone dispatches at two cents each is already spoken of.

*** It is rumored that one prominent officer of the Baxter Overland Telephone Company of Philadelphia is making things very warm for his partners, and that they now regret that they did not hold on to what funds they raised on their sales of stocks to the lambs. Instead of embarking in the telephone business and starting an exchange, they should have been wiser and stuck to the stock racket, which they as well as the Drawbaugh people have really made a success.

*** It is announced that proposals have been made to the Hawaiian Government by an Australasian cable syndicate for the laying of an ocean cable from Brisbane, Australia, to San Francisco, communicating between and through the islands of Hawaii, Maui, Molakoi, Oahu, and Kanai. The committee of the Hawaiian Legislature has submitted a report favoring the granting of a subsidy of £100,000 per annum for fifteen years, and a bill in accordance therewith was presented by the committee. It was promptly passed to a third reading, and made a special order for August 18. No information of final action has yet been received.

*** The West Coast Telephone Company formed to construct a line of telegraph through Chili, Bolivia, Peru, Ecuador, and Columbia, was incorporated at Albany last Friday. The principal office will be in New York, and the present capital is $1,000,000. Mr. Andrew B. Uline, of Albany, takes 1,000 of the 20,000 shares. The remainder are subscribed for by parties in Newburyport, Mass, and Auburn. The capital stock of the association may be increased from time to time by the vote of three-fifths in amount of all the capital stock then outstanding at any regular or special meeting of the stockholders.

*** Among the improved forms of acoustic apparatus, mention may be made of the electro-magnetophone, which attracted so much attention at the Munich Exhibition. This instrument consists of a tin disc fixed at the bottom of a hollow cone, having above it an electro-magnet, and beneath it a mercury cup, into which dips a metallic point. When the current passes, the electro-magnet attracts the disc and breaks the contact with the mercury; the current ceases to pass, and the contact is set up again, so that the disc is set in motion in the same way as the vibrator of a Ruhmborff coil. There may be obtained in this manner from 400 to 440 vibrations in a second. The sound thus produced is very intense, and it is thought possible to obtain in this way sounds loud enough to be employed as fog signals.

*** We mentioned of the total development of the systems exploited by the Belgian Bell Telephone Company: It is to be remarked that, by the intercommunication of certain offices connected with the central offices, lines of great length have already been used. Lengths of fifteen or twenty kilometers are used in each one of these systems, but especially in the Antwerp district, to which is connected the military system of that place, there exists a combination of lines having a length of nearly thirty-three kilometers.

It should be remarked that this combination is complicated by the interposition in the circuit of five call bells, which, by their supplementary resistance, augment still more the total resistance to be overcome. Notwithstanding that, the working of magneto-electric call bells imported into Belgium by the International Bell Telephone Company, of New York, as well as the communication by the Blake microphones and the Bell receivers, are carried on without any difficulty.

### Statistics of the Telephone System.

Our readers will find below the first table of information upon the progress of the European telephonic installations, including England, Belgium, France, and Italy. The most summary examination will show the rapid and considerable progress which this industry continues to make in Europe.

In Italy (where we still lack statistics of Turin and Genoa) out of a total of 5,301 subscribers, 1,591, or 30 per cent., have been added during the last thirteen months.

In France the progress for the year is 15 per cent., or 796 to 5,535. In Belgium the progress is only 9 per cent., 194 to 2,284, but it must be remembered that this is only taken upon six months and a-half.

In England the progress is: At London, 25 per cent., 785 to 3,350; at Liverpool and Manchester, 17 per cent., 475 to a total of 2,734.

| Names of Companies. | Towns. | Number of Subscribers in 1883. | Number of Subscribers in 1884. | Increase. |
|---|---|---|---|---|
| | *Italy.* | | | |
| Societa Telefonica Lombarda | Milan | 520 to the 30th June, 1883 | 1,052 to the 31st July, 1884 | 532 in 13 months |
| Societa Telefonica per l'Italia Centrale | Florence | 513 to the 30th June, 1883 | 733 to the 31st July, 1884 | 220 in 13 months |
| " " " | Bologna | 312 " " " | 427 " " " | 115 " |
| " " " | Livourne | 231 " " " | 310 " " " | 79 " |
| | | 1,056 | 1,470 | 414 |
| Societa Generale Italiana di Telefoni | Venice | 185 to the 30th June, 1883 | 190 to the 31st July, 1884 | 5 in 13 months |
| " " | Rome | 939 " " " | 1,325 " " " | 386 " |
| " " | Naples | 525 " " " | 641 " " " | 116 " |
| " " | Palermo | 246 " " " | 320 " " " | 74 " |
| " " | Messine | 114 " " " | 124 " " " | 10 " |
| " " | Catane | 125 " " " | 179 " " " | 54 " |
| | | 2,134 | 2,779 | 645 |
| | *France.* | | | |
| Societe Generale des Telephones | Paris | 2,992 to the 4th Sept., 1883 | 3,563 to the 4th Sept, 1884 | 571 in one year |
| " " | Alger | 18 " " " | 22 " " " | 4 " |
| " " | Bordeaux | 280 " " " | 322 " " " | 42 " |
| " " | Le Havre | 191 " " " | 198 " " " | 7 " |
| " " | Lille | 128 " " " | 146 " " " | 18 " |
| " " | Lyon | 528 " " " | 563 " " " | 35 " |
| " " | Marseilles | 336 " " " | 380 " " " | 44 " |
| " " | Nantes | 89 " " " | 92 " " " | 3 " |
| " " | Oran | 30 " " " | 48 " " " | 18 " |
| " " | Rouen | 62 " " " | 96 " " " | 34 " |
| " " | St. Pierre-Calais | 85 " " " | 105 " " " | 20 " |
| | | 4,739 | 5,535 | 796 |
| | *Belgium.* | | | |
| Compagnie Belge du Telephone Bell | Bruxelles | 556 to the 15th Dec., 1883 | 631 to the 31st July, 1884 | 75 in 6½ months |
| " " | Anvers | 748 " " " | 794 " " " | 46 " |
| " " | Charleroi | 208 " " " | 188 " " " | less 20 |
| " " | Gand | 272 " " " | 318 " " " | 46 in 6½ months |
| " " | Verviers | 256 " " " | 303 " " " | 47 " |
| | | 2,040 | 2,234 | 194 |
| | *Great Britain.* | | | |
| United Telephone Co. | London | 2,565 to the 30th April, 1883 | 3,350 to the 30th April, 1884 | 785 in one year |
| Lancashire and Cheshire Telephone Co. | Liverpool, Manchester, Southport, Blackburn, etc. | 2,359 to the 30th June, 1883 | 2,734 to the 30th June, 1884 | 475 in one year |

### Permanent Magnetism.

In these days of dynamo-electric currents with all their powerful effects, it will surprise many to learn that in the production of permanent magnets, we are unable to equal results that were made public nearly one hundred and forty years ago; results the method of producing which unfortunately is unknown.

November 15, 1744, Gowin Knight, M. B., F. R. S., exhibited before the Royal Society of Great Britain the results of his experiments in magnetism; a full account of which will be found in Trans. R. S. Vol. X., page 678, of which the following is an abstract:

"Mr. Knight, of Madgalene College, in Oxford, being introduced to a meeting of the Royal Society, produced before the gentlemen there present several curious artificial magnets contrived by himself, some of which consisted of plain bars of steel naked, and other of bars or blocks of the same substance; armed with iron after the common manner of natural loadstones; but as he was apprehensive, the trials he had made of the weights these magnets were respectively capable of lifting, could hardly be repeated with sufficient exactness and advantage before so large a company, he desired to refer himself to what the President had seen at his lodgings on the 7th and 13th of the same month.

"Whereupon the President acquainted the company that he had been several times at Mr. Knight's lodgings, where he had seen many experiments made with his artificial magnets, and that, particularly on the days above mentioned he had been present, and had taken minutes of the following trials then made by that gentleman, by which it appeared, that—

"A small eight-cornered bar of steel, of the length of 3 inches, and almost $\frac{7}{10}$, and of the weight of about $\frac{1}{2}$ an ounce Troy, lifted by one of its ends about 11 of the same ounces.

"That another plain bar of steel of a parallelopiped form, of the length of $5\frac{9}{10}$ inches, the breadth of $\frac{4}{10}$, and the thickness of $\frac{3}{10}$ of an inch, weighing 2 ounces 8½ pennyweight, lifted in like manner by one of its ends 20 Troy ounces.

"That a steel bar, almost of the same form as the last, but only 4 inches in length, capped or armed with iron at each end, cramped with silver, and weighing all together 1 ounce 14 pennyweights, lifted by the feet of the armor 4 pounds Troy.

"Then a single block of steel of parallelopiped form, almost 4 inches long, $1\frac{3}{10}$ inch in height, and $\frac{4}{10}$ of an inch in thickness, armed with iron, cramped with brass, suspended by a ring of the same, and weighing all together 14 ounces 1 pennyweight, lifted by the feet of the armor 14 pounds 2½ ounces Troy weight.

"That a compound artificial magnet was also tried, consisting of 12 bars of steel, armed, and that it was found to lift by the feet of the armor as the last, 23 Troy pounds, 2½ ounces.

"That 12 bars, comprising this last magnet, were each a little more than 4 inches long, $\frac{8}{10}$ of an inch in breadth, and $\frac{16}{100}$ of the same in depth, weighing one with another about 25 pennyweights each. They were placed one upon another, so as to make together one parallelopiped body of the common length and breadth of the several bars, but of the height of near 2 inches, being the sum of the respective thicknesses of all the bars taken together; and this parallelopiped body, being cramped with brass, and fitted with a handle of the same metal, was armed at the two ends that were made up of the common extremities of all the bars, with two substantial pieces of iron, after common manner of arming natural loadstones, the whole frame weighing together about 20 Troy ounces."

"After this report, Mr. Knight proceeded to show at the meeting some of the same artificial magnets therein mentioned; and it was found that the compound magnet, consisting of 12 steel bars, which had, in the experiment made before the President, lifted 23 pounds 2½ ounces Troy weight, did here, under all the inconveniences and disadvantages of a crowded room, still lift a weight amounting to 21 pounds and 11 of the same ounces.

"It is also found that the single armed block of steel, which had before lifted 14 pounds and 2½ ounces, did here, under the same disadvantages as the former, lift 13 pounds and 7 ounces of like Troy weight."

* * * * * * * * *

"P. S.—Since the artificial magnet mentioned in the forgoing paper, Mr. Knight has caused some others to be made of a lesser size, but of very great lifting power; and one of these, weighing without its armor just an ounce, and with the armor, cramps, and rings, 1 ounce 17 pennyweights, lifted before the President of the Society, on July 27, 1745, 6 pounds and 10 ounces Troy weight.

"This magnet consisted of three plates of steel, each 2 inches long, $\frac{7}{10}$ of an inch in breadth, and not above $\frac{6}{100}$ of an inch in thickness; they were laid flat upon each other, and screwed together by two small brass screws going through the three plates; after which the little parallelopipe block so made up was armed with iron at the two ends, cramped with silver, and fitted with a double ring of the same metal for the convenient holding of it."

* * * * * * * * *

In the transactions of Royal Society, vol. 66, page 591, appears a paper by John Fothergill, M. D., F. R. S., which was read June 27, 1776. "To the President and Fellows of the Royal Society, Gentlemen: By being left executor of your late worthy member Gowin Knight, M. B., a very extraordinary magnetic machine of his contrivance, and which has cost him much labor and expense, came into my possession. This, I thought, might not be unworthy of a place in your repository; and I therefore desire your acceptance of it as a monument of Dr. Knight's very singular abilities, and of my regard to the purposes of your institution.

"I must, however, inform you, that this machine which by the annexed figure and

its explanation, may be observed to consist of two parts, is by no means so strongly magnetical as it was at the doctor's decease. Not long after this event, it was necessary to remove this apparatus from his apartments in the British Museum. One of these parts was fixed up in your museum; the other was left at the lodgings of one of your very useful, ingenious members, J. H. De Magellan, for the purpose of some experiments, and also for impregnating strongly the needles of sea compasses. Here it was accidentally destroyed by fire, and the parts it consisted of rendered almost wholly useless. A new one has, however, been made, and impregnated with the magnetical power by the ingenious gentleman above mentioned, according to the method of Dr. Knight. It has acquired a considerable degree of magnetic force by being placed in the polar line with the other part of this machine that was unhurt, and where in time it will, perhaps, acquire a considerable degree of magnetic energy.

"I wish it had been in my power to have given a minute and pertinent detail of my deceased friend's discoveries in this branch of knowledge. He acquainted me, it is true, at different times in conversation, of the progress he made in these discoveries; but, as I then thought he intended to leave behind him an exact account of his experiments and researches and their result, I rather listened to his relations as matters of instructive amusement, not thinking it would ever be necessary for any other person than himself to give the public an account of his labors. Indeed there are many useful memorials of his on this subject, in your collections, to which I must refer the inquisitive reader. I shall only mention some circumstances relative to this machine which I do not know have been related either by himself or any other person."

* * * * * * * * *

"I imagine a view to have such a degree of magnetic power at his command, as to force the magnetic virtue through the most consolidated bars, was his first inducement to try, whether he could not collect such a magazine of magnetism, as would be sufficient for every purpose of this kind, and at the same time exhibit some new phenomena in physics yet undiscovered. With this view he planned and executed the machine, described at the end of this relation.

"His first attempt, however, was much smaller; a few bars were laid in the due course of the magnetic flux, and impregnated by constant attrition. To these other bars were added successively after they had been unpregnated, both by the force he could give them by attrition and what he could derive from the preceding stock collected in the bars. To these he added still fresh bars, till he had formed the whole mass as it is now presented to you, and resting on wheels and pivots in such a manner as to be easily manageable for the purpose of impregnating the needles he was employed to see prepared for the service of the government, and others who had generosity enough to think that the compass, on which depended the lives of the ship's crew, could not be made too perfect, and that it deserved a reasonable compensation. It is to the doctor's ingenuity and indefatigable attention to this useful instrument, that it has acquired amongst us a degree of perfection unknown to our predecessors.

"When the machine was completed, he still was adding continually to its powers. He impregnated every single bar of which it is composed by repeated attritions, and applied it to the remaining bars in their magnetic position. After this operation, he always found its efficacy for a season, considerably diminished; for the effluvia of each bar, though increased in virtue, seemed not immediately to have acquired a communication with each other. However, it grew always more powerful after each of these operations; and it is more than probable, if a person could be found, who, with equal patience and skill, would at proper distances repeat the same process, that the present machine would acquire a degree of force superior to what the original ever possessed, for much depends upon time and a due position."

* * * * * * * * *

These magnetic machines, as shown by the drawing and description, were each composed of 240 bars, 15 inches in length, 1 inch in breadth, and $\frac{3}{5}$ of an inch thick; four compound sections of 60 bars each composed the machine. These sections were placed end to end, with all the like poles of the bars in the same direction; the result being a parallelopidon 6x6x60 inches; this was placed upon a carriage and supported by trunnions at the center, like a cannon; it was capped at both ends with plates of iron about 1 inch thick, and lateral plates of iron were placed at the junction of the sections; there was also an arrangement by which all the bars could be clamped into the closest possible contact. They are described as each weighing with its carriage about 500 pounds, but this is evidently incorrect, as it will be found that the metal contained in the dimensions given above would, without the carriage, amount to about 630 pounds.

It is true that the magnets specially referred to as exhibited before the meeting are not remarkable, but those recorded as having been exhibited to the President are beyond anything that has been produced since to the writer's knowledge. It has been suggested that adhesion may have operated to augment the effect, but considering the small surface of contact, this seems an inadmissable explanation; therefore, unless we conclude that deception was practiced, and that the weights lifted were in reality powerful magnets, which the circumstances preclude, we must believe as the only alternatives, that the results were due to the method of magnetization, the nature of the steel on the combined effect of both of these.

The science of to-day may be challenged to produce a simple bar magnet of ½ ounce that will lift with one of its ends 11 ounces or a compound horseshoe magnet weighing 1 ounce with a portative force of 82 ounces. These weights lifted represent the full capability of induced magnetism of the respective weights of the magnets in soft iron; while all that M. Trouve claims to have accomplished by his improved methods is a portative force of 14 times the weight for bar magnets, and 56 times for horseshoe magnets.—*The Bulletin.*

WRIGHT'S CABLE CLIP.

## Wright's Keystone Cable Clip.

Wright's cable clip is well known, and is in very general use for suspending overhead cables; but the "Keystone," devised by the same inventor, which we illustrate herewith, is comparatively new. Its advantages consist in its double hook, and in the fact that each size can be used with several sizes of cable. It takes a firm grip on the cable, is strong and durable, and, while possessing all the advantages of the old clip, seems to possess some new ones. It is manufactured by the Rhode Island Electric and Telephone Company.

## Electrical Progress.

Nothing illustrates the change which has occurred in the past few years in electrical science more markedly than a comparison of the electrical exhibits at the Centennial Exposition and the present exhibition. Almost the whole display in 1876 was composed of telegraphic instruments and telegraphers' supplies. At the present exhibition the display of such instruments is comparatively small, and, indeed, the historical exhibit at the Patent Office and the Franklin Institute contains more of them than all the remainder of the exhibition together. Of that display it is unnecessary to say more than to refer the curious visitor to it. It contains not merely the models upon which all the noted telegraphic patents were issued, but one of the original instruments used to transmit the first message sent by Morse's system, and a portion of that cipher message; but what is even more important to the art, the electro-magnets made by Professor Henry, which pointed out the principles upon which magneto-electrical communication depends. Morse's instrument may be simply described as a transmitter by which an electrical circuit could be completed or broken at will, and a receiver, consisting of an electro-magnet, the motions of whose armature inscribed upon a slip of soft paper carried by clockwork a series of dots or dashes as the circuit was connected for a longer or shorter interval. The magnetism of the electro-magnet was created by the electrical current flowing from the transmitting key when the circuit was closed, about the core of the magnet. By a very slight modification the receiving operator was able to read the message by the clicking sound given by the spring of the armature. It is almost unnecessary to state that this still continues practically to be the system in use all over the country. Even the cipher system devised by Morse, and known as the Morse alphabet, continues to be used almost without change. The numerous modern improvements are modifications only of the original idea. Keys, sounders, relays and receiving instruments have changed their shapes hundreds of times, but the principles upon which they are built remain almost as they were left by Morse.

.... The State telegraph engineers of Belgium are engaged in finishing the arrangements and necessary modifications in the telegraph system and apparatus, in order to fit it for the simultaneous transmission of telegraph dispatches and telephonic conversations.

The Belgian Bell Telephone Company has also had important works to execute, as much in the interiors of their central offices as in the installation of special systems of connections, in order to permit, in the near future, all of their subscribers to use their ordinary apparatus for long-distance telephony.

In Brussels alone the length of lines laid for this purpose is about 70 kilometers This new system, added to the lines the company already possessed for connecting its subscribers, makes now, for the telephonic service of that city and its environs, a total of more than 1,100 kilometers, serving more than 600 subscribers.

For the whole of its concessions in Brussels, Antwerp, Ghent, Verviers and Charleroi, the total development of the system is approximately 4,500 kilometers, serving more than 2,500 subscribers.

Besides the concession systems, there are in Belgium a certain number of private lines. The installation of these is regulated by a royal decree, which authorizes the free construction of these lines as long as at their points of attachment, or for their passage, they are above or under private property. The authorization of the Government is necessary if the lines pass over the State domain, and they must be completely built by the staff of the Administration of Telegraphs in the parts where the property of the State is used for their points of support.

The lines in question, although having considerable length, ought not to be confounded with those of the service about to be organized for long-distance telephony between the various cities of the country. These are private lines, and it is that condition which explains the double intervention of the State and a private individual in their construction. The length of these lines, erected by the Administration of Telegraphs and by private industry, are respectively about 120 and 26 kilometers.

## TELEGRAPHIC

.... In consequence of political troubles, telegrams for Peruvian offices, other than Chorillos and Molendo, are only accepted, subject to delay and at the risk of the sender.

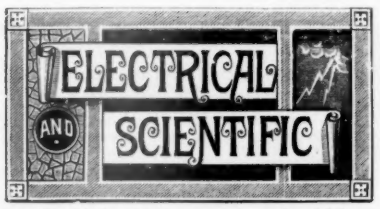
.... According to advices received by the Eastern Telegraph Company, under date of September 3d, telegraphic communication with Tien-Tsin and Pekin has been stopped by the interruption of the Chinese land lines beyond Chining.

.... A deputation of the inhabitants of Upper Hastings and Manning in New South Wales, Australia, has presented a petition to the Director-General of Posts and Telegraphs, demanding the prompt establishment of telegraphic and telephonic communication with Sidney, the want of which has been much felt. The director-general has promised to do all in his power to satisfy the wants of the inhabitants.

.... It is announced that the Emir of Bokhara has at last consented to the establishment in his territory of a telegraphic line, which will connect with the Russian telegraph system. Up to the present time the Russian lines from Tashkend are stopped at Katta Kurgan, on the frontier, and, notwithstanding several efforts, the Russian Government had not been able to obtain the consent of the Emir to the extension. The establishment of direct telegraphic communication between Tashkend and Bokhara is regarded as very important, from a political point of view, as well as for Russian commerce.

.... The corps of telegraphists in the Belgian army is divided into two companies, the first of which is intended for the telegraphic service of the army in time of war, while the second, named the Compagnie des Telegraphistes de Place et d'Artificers, is intended for service in fortified places. In time of peace each company consists of a captain with an effective of 80 men, for the most part non-commissioned officers; but in time of war each company consists of 200 men, furnished by the military engineer corps and trained for telegraph service.

.... A new telegraphic system, by which the present code is simplified, has been exhibited in Boston. Chemically prepared paper, moved by clockwork, receives the record of signals sent over the lines, which are represented by dots and dashes as in the Morse code. On the moving strip of paper rest the points of six fine iron wires or styluses and the chief feature of the new system consists in enabling the operator at the transmitting station to make a signal through whichever one of the six styluses he may choose, although only one line wire is used, and in this way to make the position of the mark which is recorded in the chemical paper play a part in determining its meaning. The new system is the application to telegraphy of the system of notation employed in music. Just as the pitch of a half-note is determined by the bar in which it occurs, so a telegraphic character is by this method given six different meanings according to the stylus through which it is sent and the position in which it is recorded. The bars of the staff are ruled by copper styluses, which make a red line on the receiving strip as it is moved forward, a constant current from a local battery being passed through them for this purpose. When a message is to be sent by hand, six keys are used at the transmitting station, each corresponding to one of the styluses at the receiving station, or one key pivoted to swing easily over six contact points may be employed. As each signal has six different meanings, according to the bar on which it occurs, only one-sixth as many are required as in the Morse system, and for these the shortest and simplest are selected. Thus, a dot is used for the six letters which occur most frequently. In this way the actual time occupied in making the signals required to send a message is reduced fully one-half from that required by the Morse system, so that the speed of transmission is doubled.




* * 99,496 men, women and children, visited the Electrical Exhibition, from its opening day, September 2d to Saturday evening, September 20th.

* * M. Duter has proved experimentally that the magnetism of flat steel magnets, whose surfaces are their poles, does not disappear when they are removed from the magnetic field.

* * An international exhibition of inventions and of musical instruments is to be opened in May, 1885, in the buildings now standing in the gardens of the Royal Horticultural Society at South Kensington, London. It is not proposed to allow space for manufactured goods unaccompanied by any illustrations of the process of manufacture.

* * An exceedingly delicate and very important instrument, among the French exhibits at the Philadelphia Electrical Exhibition, is Professor Regnard's apparatus for the study of the respiration of animals. By means of this the scientist can measure the quantity of air breathed by the animal in a given time, and make a complete analysis of it afterward.

* * Prof. I. Fujioka, M. E., of Tokio, Japan, sent specially to the International Electrical Exhibition, Philadelphia, by the Japanese Government, has been appointed by the Board of Managers of the Franklin Institute a member of the Board of Examiners at the said Exhibition. A few years ago he was under Prof. W. E. Ayrton, F. R. S., who was materially assisted by the young Japanese in most of his remarkable experiments, which made him so famous since then.

* * On the occasion of the Exposition at Antwerp the Belgian Government issued a decree for the protection of inventions and trade-marks, according to the terms of which any inventor of an object susceptible of being patented, can, if it is admitted to the exposition, procure from the Governor of the Province of Antwerp, a certificate descriptive of the object exhibited. Up to the end of the third month following the closing of the exposition, this certificate will confer the same rights as a patent in Belgium.

* * To phosphorize bronze or brass wire place it in a solution of from $\frac{1}{8}$ to 5 per cent. of phosphorus in ether, bisulphide of carbon or olive oil, 5 to 10 per cent. of sulphuric acid, and 85 to 95 per cent. of water, until the metal begins to take up the phosphorus. The wire is then drawn to one number finer, and placed in a closed retort, with a thin layer of phosphorus, so that the phosphorus vapor may spread over the surface of the wire. The wire is then packed in charcoal, which is kindled, and after proper annealing the wire can again be drawn to a finer number. This process is repeated until the desired fineness is attained. Wire thus phosphorized is very tough, takes a high polish, and is not easily corroded.

* * In an article on the prospects of young engineers, the London *Engineer* thus alludes to the necessity of combining scientific knowledge with scientific attainments in order to achieve commercial success: "We often hear German and French engineers extolled for the results of their scientific training. What are the locomotives or marine engines which have resulted from it like? The Americans have been the least scientific engineers in the world, yet they have modified engine-building practice all over the world. Germany and France have been unable to compete with us without buying engines from us to copy. Science may prevent a man from making enormous mistakes; it cannot tell him how to produce even moderate commercial success. Standing alone, it is entirely helpless in commercial mechanical engineering; combined with sound practice, it is useful."

* * McGill University Convention, Montreal, has conferred the honorary degree of LL.D. upon the following prominent members of the British Association in commemoration of its meeting in Montreal: President Lord Rayleigh, the Governor-General of Canada, Sir John A. MacDonald, Sir Lyon Playfair, Sir William Thomson, Professor Bonney, Professor Frankland, Captain Douglas Galton, A. G. Vernon Harcourt, Sir Henry Roscoe, Professor Blanford, Professor Moseley, General Lefroy, Sir Richard Temple, Sir F. Bramwell, E. B. Tylor; also upon the President of Toronto University, Professor Daniel Wilson, Prof. Asa Oray, of Harvard, and Professor James Hall, New York State Geologist.

* * One of the most interesting applications of electricity to everyday life is that which guards the traveler from the danger to which railways are liable. Telegraphic communication has done much to lessen these dangers, and in the block signal service adopted on the Pennsylvania Railroad it reaches its highest utility. The danger signal system of the Railway Cab Company differs from this and all similar devices in needing no personal vigilance to maintain its efficiency or to heed its signals. A defect anywhere gives warning of danger, not upon the line or depending upon the vigilance of the engineer, but in the cab of the engine itself, where the shrill whistle of escaping steam commands the attention of the engineer.

* * M. Roemer has found a process for the economical production of bichromate of potash, which consists in melting together 100 parts of chrome ore with 150 parts of potash aad 30 parts of soda. The levigation is effected, as usual, with water; and the resulting liquor, which contains chromate of potash and chromate of soda, is treated with sulphuric or hydrochloric acid in suitable proportion to form bichromate of potash and sulphate of soda. By evaporation the bichromate of potash becomes crystallized. An equivalent of neutral bichromate of potash, with an equivalent of neutral chromate of soda, require an equivalent of monohydrated sulphuric acid, and yield an equivalent of bichromate of potash, an equivalent of sulphate of soda, and two equivalents of water.

* * The carbons used in electric lighting may be divided into those employed in arc lights and those employed in incandescent lights. The former consist of hard pencils or electrodes, and the latter of variously-prepared filaments of high electrical resistance. In the marked improvements that have of late been made in systems of electric lighting, those effected in the direction of obtaining better carbons of both kinds form no inconsiderable part. As regards cost, arc carbons are to-day selling at prices probably two or three hundred per cent below their market value a few years ago. Then, too, they have improved markedly in their uniformity of structure and in their duration. Carbon pencils are now made, twelve inches of which will burn for from nine to twelve hours with the currents ordinarily employed.

* * At the exhibition the Wharton Railroad Switch Company exhibit the Hall system of automatic electrical signals in the annex. The Hall system consists of a block system for railroads, the signals being operated by local circuits, which are interrupted by the passage of a train. A trip-lever is arranged by the side of the track, which is acted upon by the thread of a wheel passing over it. This lever, working upon a piston, breaks a current which supplies an electro-magnet. When the current is broken, the magnet releases its armature, which, falling, displays a danger signal, thus blocking the road. At the same time, or immediately after, the current to the preceding danger signal is closed, and that danger signal is raised. Thus each train at the end of a block sets the danger signal behind it and removes that from the block before.

* * The same relation that exists between the boiler, the producer of steam, and the steam engine, the contrivance that utilizes the steam, exists also between the dynamo-electric machine, the great modern producer of electricity, and the carbons that are used to convert the electricity into light. To secure the cheapest conversion of energy of any kind into the artificial light produced by the different systems of electric lighting now in use, we must attain the highest possible economy in the double conversion of mechanical energy into electrical energy, and of electric energy into light. The relative economy of conversion of mechanical into electrical energy is far greater than that attained in the conversion of the energy in a lump of coal into the mechanical energy produced by the steam engine. This, indeed, is a fortunate circumstance for the future of the dynamo-electric machine, since steam-power is the source to which we must probably look for a long while as the prime motor for dynamos. An increase in the economy of our modern systems of electric lighting is to be looked for not so much in the direction of greatly improved dynamos, though marked improvements in these are still possible, especially in the direction of the steadiness of the current they produce, as it is in the composition and structure of the carbons that are employed to convert the electricity into light. We need cheaper electricity, and cheaper and better carbons, but just now we stand in greater need of the latter than of the former.

* * Sir William Thomson, in an address before the National Conference of Electricians, at Philadelphia, paid the following tribute to an American and an Englishman, who did so much for the practical development of electrical science:

"I fear I have taxed your patience too long, but I cannot sit down without again reflecting on the men whose lives have been patterns to the world. There is none more remarkable perhaps than the man of this country, Joseph Henry, who ended his days here. He and Faraday were patterns of scientific investigators. In some degree they went parallel and made similar scientific discoveries. Henry, indeed, preceded Faraday in the great discovery of the electro-magnetic induction between unmoved conductors. Henry gave the warmest welcome to all practical applications of his discoveries. He sought to make none himself, not because he superciliously despised the applications of science to the public good, but because his own convictions constrained him to go on in pure science; because he felt, as Professor Rowland has said so well in respect to Faraday, that it would have taken him from his work to have devoted himself at all to the practical applications of his discoveries. But what a beautiful trait of character it is to see what a kindly welcome he gave to those who did make the practical applications. He saw what might be done, but deliberately left it to others.

"I know no other parallel to Henry's action in this respect, except that of Faraday himself. The beautiful and simple manner in which Faraday describes the dynamo, which is making such a mechanical and engineering revolution in the world, is remarkable: 'Put a little more wire together, make the thing a little larger, and there is a vast power there, competent to do great things.' I wish I could remember his words. He says, in the very simplest manner, that he must leave this to others. 'I have to go on; I have something before me that I must do. This will be done. This will come, perhaps, but not by me. I have only been able to clumsily repeat the idea in ten times the number of words, as I remember it, from reading his paper a long time ago. He thought little of the practical application; but it was not one of those gifts given with an off-hand generosity, because the giver did not value it. Faraday valued the practical application. He was, like Newton, in the public service as an engineer. He was scientific adviser to the English Board of Lighthouses, as Henry was scientific adviser to the United States Board of Lighthouses.

"The friendly welcome that Faraday gave to the dynamo is quite refreshing to think of. When he was first shown a great dynamo with power enough to produce the electric light, he said: 'I give it to you as an infant, and you bring forward the child as a giant.' No one took a greater pleasure in the application of his science than Faraday. He was content to stand by and see the great results that were obtained, while he remained at work in the Royal Institution to the very end of his working days, trying to see deeper and deeper into the properties of matter, and trying to penetrate further along that line of investigation."

## The Electric Lighting of the Ironclad Richelieu.

The electric light is now generally used on war vessels for nocturnal investigations by means of search lights, but only a few powers, such as England, France, Italy and Austria, have adopted electricity for the illumination of the interior of ships.

The advantages of electric lighting were promptly recognized by the principal merchant shipping companies, and the recent installation made by MM. Sautter, Lemounier & Co., upon the ironclad Le Richelieu, has proved that it is the same with vessels of war; but, in this case, the conditions to be fulfilled being more numerous and essentially different, a special arrangement is required.

The Gramme dynamo furnishes a current of 200 to 250 amperes at a normal speed of 580 revolutions; the electromotive force at the terminals is 51 to 52 volts, and the internal resistance does not exceed 0.008 ohm. The electro-magnets are excited in derivation, which absorbs 22 amperes. The machine is used to supply 211 incandescent lamps of 8 candle-power for the interior lighting, and 16 lamps of 30 candle-power for the signals, etc.

The electromotive force of the machine is kept constant, whatever may be the number of lamps in circuit.

The low-resistance armature is composed internally of 100 bars of copper, forming a cylinder 180 millimeters in diameter, and insulated from each other by card-board soaked in a bath of bitumen.

The extremities of this cylinder are turned to form the collectors upon which the brushes of silvered copper wire are supported.

The field magnets are formed of eight round iron bars of 0.80 millimeters, connecting the base of the machine with the upper plate, and having in the middle the cast-iron pole pieces. This machine is extremely strong; at a speed of 580 revolutions it absorbs 25 horse-power to supply 400 lamps of 8 candle-power, or 200 of 16 candle-power. But this speed, although high for a motor driving direct, may be, without injury to the dynamo, raised to 900 revolutions; the electromotive force and the work absorbed are then doubled, and it will supply 800 lamps of 8, or 400 lamps of 16 candle-power. The machine occupies very little space, less than a meter square at the base, and nearly one meter in height. Being used at a low speed, it is quite suitable for the lighting of war vessels, for, as it is worked far below its maximum of production, it will last for a long time.

The Edison lamps installed upon the Richelieu are divided into seven circuits, namely:

1. The day circuit (68 lamps of 8 candle-power). 2. The night circuit (79 lamps of 8 candle-power). 3. The war circuit (16 lamps of 8 candle-power). 4. The machine circuit (26 lamps of 8 candle-power). 5. The sea circuit (22 lamps of 8 candle-power). 6. The navigating light circuit (6 lamps of 30 candle-power). 7. The signal light circuit (10 lamps of 30 candle-power).

All these circuits form branches of the installation, and each serves for a special purpose:

The day circuit works night and day; it is used for the lower part of the ship, which is dark even during the day; the night circuit illuminates the sleeping berths, cabins, etc.; the war circuit belongs to the ammunition rooms, etc.; the machine circuit serves for examining every part of the machinery, and for making repairs; the sea circuit completes the lighting of the machinery and boilers; the navigating light circuit comprises three stern lights, two side lights, and one lantern; the signal circuit supplies the lights placed in the masts during the night.

All the lamps, except the lanterns of the navigating and signal lights, are Edison B lamps of 8 candle-power, working with 50 volts and 0.75 amperes.

They are variously mounted, according to the places to be lighted, but everywhere special precautions have been taken to neutralize the vibrations produced by the engines

and the shocks from the reports of the cannon. For this purpose there is placed between the wall of the vessel and the support a disc of felt 10 or 15 millimeters thick, and each lamp is connected with its support by two small wooden sockets and a spiral spring, which considerably decreases shocks.

In all the sleeping berths and places occupied by the crew, the lamps are inclosed in lanterns which can only be opened by special triangular keys.

Movable apparatus is required in some situations; the lamps are then suspended by three chains.

In the officers' rooms and cabins the supports closely resemble the ordinary form used for candles. They are all nickel and tin-plated, and the lamps provided with opal shades.

The masters' cabins are provided with similar apparatus, simply bronzed, and with tin reflectors. The same form is adopted in the machine-room. In the passages and store-rooms the lamps are simply protected by glass domes. The seven circuits described above are connected with a switch-board placed near the machine. Each is manipulated by a commutator which allows of lighting or extinguishing the lamps on any of the circuits at a moment's notice; moreover, in each circuit a certain number of lamps are provided with individual commutators, turned by special keys.

The conducting wires, well insulated, are everywhere placed upon wooden boards fixed to the walls of the ship or inclosed in metal tubes. Their preservation is insured by covering with wood.

The sections of the conductors have been carefully calculated and the points of departure of the principal derivations chosen, so that in each circuit the difference of potential between the two wires of the last lamp differs not more than a volt from that at the switch-board.

As, on the other hand, the difference of potential at the terminals of the machine is practically constant, the total intensity of the current is always proportional to the number of lamps illuminated. No regulation is therefore required on lighting or extinguishing one or several circuits. It is sufficient to turn the corresponding commutators upon the switch-board, always letting a short time elapse before turning another commutator, in order to allow the regulator of the steam engine time to act and maintain the speed.

MM. Sautter, Lemonnier & Co. have communicated to the *Revue Industrielle* a very interesting project which might be adopted where a compact electric light installation is required on board a war vessel. Without departing very considerably from the arrangements described above, it would be easy to supply the search lights by a group of machines identical with those which belong to the interior lighting. One of these groups would be sufficient for lighting lamps always in use, and the other would serve alternately for the search lights and the interior lighting. It would even be possible, by means of very simple arrangements, to utilize the disposable currents for the transmission of power to certain portions of the ship, for example, to the repairing room.

In conclusion, this project would consist in establishing in a very small space an apparatus producing electricity, capable of being utilized for interior lighting, for search lights, for arc lights for embarkation and debarkation, and lastly, for the transmission of motive power.

### The Overland Telephone Company of Utica, New York.

Our contemporary, the Utica *Herald*, has the following concerning the Baxter-Overland Company of that place, from which it would seem their career is to be even shorter than that of the Baxter Company of Philadelphia, which started out with so much noise a few months since, but recently discontinued we are informed, through disagreements among themselves, brought about, no doubt, through their inability to sell any more stock. Their exchanges at Philadelphia and Utica are, we believe, the only ones they have tried to start.

Saturday morning last there was filed in the office of W. S. Doolittle, clerk of the United States Circuit Court for the Northern District of New York, a complaint in a suit brought by the American Bell Telephone Company against the Baxter-Overland.

The Central New York Telephone and Telegraph Company has been doing a very successful business in eleven counties in Central and Northern New York for a number of years past, and operates over 1,000 miles of wire. The Baxter-Overland Telephone and Telegraph Company of Central New York was organized last spring, and it has an exchange in Utica which it expects to put in operation about October 10.

The complaint in the case is a printed pamphlet, with spaces left blank, in which the names of the defendants are inserted. Its wording shows that the printed portion was prepared to be used in any case of infringement of the Bell patent. It is a voluminous and comprehensive document. An abstract of the complaint may be of interest. It opens as follows:

The American Bell Telephone Company, a corporation duly established under the laws of the Commonwealth of Massachusetts, and the Central New York Telephone and Telegraph Company, a corporation duly established under the laws of the State of New York, bring this their bill of complaint against the Baxter-Overland Telephone and Telegraph Company of Central New York, a corporation duly organized under the laws of the State of New York, and exercising its corporate franchise in the city of Utica, within said judicial district, Joshua Mather, Charles W. Mather, T. Jay Griffiths, Samuel S. Lowery, Charles L. Bartlett, James B. Turnbull, George M. Lowery, Andrew W. Mills, Henry J. Coggeshall, Robert H. Roberts, Frank A. Ethridge and Charles A. Rolfe.

The complaint recites that Alexander Graham Bell received patents on his inventions as follows: March 17, 1876, for seventeen years, and January 30, 1877, for seventeen years. He assigned these to Gardner G. Hubbard, July 28, 1877. Hubbard assigned them to the Bell Telephone Company, July 20, 1878. The Bell Company assigned them to the American Bell Telephone Company, June 22, 1880. The Central New York Telephone and Telegraph Company has assigned by license the right within a territory, which includes Utica, to use telephones to be furnished by the American Bell Telephone Company. Telephone exchanges made the license of this company exist in more than one thousand towns and cities of the United States.

The bill further says: The transmission of articulate speech telegraphically, according to the method invented and patented by Bell, constituted an entirely new industrial art; and the manufacture and introduction into use of instruments and apparatus for such purpose is an industry which was originally created under the said patents to Bell, and which has been developed wholly and solely by the means of the said patents and their licensees. There are now in use more than 300,000 electric speaking telephones licensed by and paying royalty to the American Bell Telephone Company.

The complaint then gives a list of all persons and corporations against which it has brought suits. Some of these suits have been settled and discontinued, and others are still pending.

The complaint states, rather sarcastically, perhaps, that "the defendants have been and are deriving and receiving considerable gains and profits from and by reason of their making, using, and furnishing to others for use, and selling the infringing telephones aforesaid," etc.

In conclusion, the complainant asks that the defendants be decreed to pay over all gains and profits they have made, to pay damages sustained because of the infringement, and that they be perpetually enjoined from making, selling, or using said telephones; that they be enjoined while this cause is proceeding, and to pay the costs of the suit.

Under the rules of practice the defendants are required to appear in the case on the first Monday in November; their answer must be filed by the first Monday in December.

The complaint is signed by W. H. Forbes, president of the parent company, and by R. S. Williams, president of the local company. The affidavit of Mr. Forbes attached, is dated July 23, 1884.

—— It was announced several weeks since that Mr. George C. Pyle, of Akron, O., had perfected a lamp, dynamo and engine for locomotive use, and it was being tried on four different roads, one of which was the New York, Pennsylvania & Ohio. It has now been used on runs aggregating 40,000 miles, and with the highest satisfaction. An excursion from Akron to Cleveland was made a few evenings since by numerous practical railroad men, for the purpose of observing it. The lamp burned steadily without flickering, and gave a very brilliant light, which showed far down the track, 20 telegraph poles being clearly visible in advance of the moving train.

—— Considerable difficulty is experienced in the manufacture of arc light carbons in obtaining the pencils free from curvature. Since in most of the arc light lamps the carbons are placed vertically over each other in the direction of their length, should the upper carbon have even a slight curvature, when the mechanism of the lamp feeds the upper carbon and allows it to drop towards the lower one, it is quite apt to pass it. In this case an unsteadiness in the light results, and often its complete extinguishment results from the lateral welding together of the carbons. For the same reasons carbons that burn away to long conical points are considered very objectionable in practice.

—— Trouve's electric lamp for surgeons obviates the necessity of shifting the light with each movement of the patient. The entire apparatus is attached to a frontal plate padded on the inside and secured to the forehead by an elastic band or by springs like those of a fencing mask, or by means of a spectacle frame resting on the nose, or it may be fastened to a cap or other headpiece. The lighting portion is mounted on the frontal plate by a ball-and-socket joint, the ball being united to a plate, which may or may not be furnished with a reflector, and which forms the ends of a cylindrical casting, upon which fits a tubular socket carrying the source of light. It can be used in mining, etc.

——During Dr. Taylor's absence in Europe, the trustees of the Broadway Tabernacle have introduced the electric light into that well-known structure, and the fact will possess peculiar interest for the members of all city churches, and also for the managers of public buildings generally. The incandescent lamps used by the Edison company in the buildings of their downtown district are undoubtedly soon to be used in the better class of private houses throughout the city, but it has not yet been determined what system is best for the illumination of public buildings. Sufficient progress in the development of the electric light has been made, however, to ensure satisfactory results from more than one system. The advantage of electric light in churches will not consist chiefly in the superiority of the illumination as compared with that of gas light, but rather in the avoidance of heat and of the vitiation of the atmosphere. The evening congregations of the Broadway Tabernacle will not only be able to see better than formerly, but they will also breathe purer air and worship with greater comfort, especially in the warm season. The trustees have also improved the ventilation of the building, and the changes effected during the summer deserve the attention of the managers of public buildings generally. Prof. George P. Fisher, the distinguished Yale theologian, who always pays particular attention to the ventilation of the room in which he delivers his lectures to students, says that the torpor of preachers and drowsiness of congregations are often the result of a lack of proper ventilation, and his wise suggestion should have the attention of church trustees who are considering the advantages of electric light.

## ELECTRIC LIGHT NEWS

—— The Nashville Cotton Mills, at Nashville, Tenn., have just put in 350 incandescent lamps, United States system.

—— The United States Post-Office Buildings at St. Louis and Chicago are each lighted with 750 incandescent lamps, recently put in by the United States Electric Light Company.

—— The manufacture of electric headlights for locomotives has begun at Akron by the American Locomotive Electric Headlight Company, of which Lewis Miller, of Akron, is president, and Mr. Lynn, formerly of Indianapolis, is acting superintendent.

—— A trial of incandescent lighting is now being made in the London and Northwestern line. A locomotive running one of the trains between Liverpool and Manchester has been fitted with a Brotherhood engine and a dynamo, the latter supplying the requisite current to a Swan lamp in each of the compartments of the train. A duplicate lamp is also provided, and so arranged that it would be switched into the circuit directly the other lamp went out. The current is regulated by a switch, a pilot lamp indicating to the driver the candle-power at which the lights are burning.

—— The Boston and Providence road has in use in some places, and the Bee Line in Ohio has recently introduced at several important crossings near small towns and cities along its line, a system of electric bells. As soon as the engine strikes a point about 600 feet from the crossing the forward trucks set an electric gong to ringing, and it rings until the whole train has passed the crossing and opened the circuit, when the bell ceases its racket. The device reduces the danger of crossing accidents to a minimum, and yet there are citizens living near the crossings who complain of the noise of the gongs.

—— Wednesday night an electric-light wire came in contact with wires of the District Telegraph Company at Waterbury, Conn., sending a heavy current of electricity through them. Manager Sawyer, at the District Telegraph office, received a severe shock in disconnecting the wires, which threatened to set fire to the office, and the watchmen in several factories, while giving the night signal over the district line, were shaken up. The entire system was filled with the current, and the escape from a serious accident is considered remarkable. The District Telegraph service was completely demoralized.

—— The Harris-Corliss Engine Works, Providence, are very busy, having under way some heavy machinery, among which is one engine thirty inches by seventy-two inches; fly-wheel, twenty-four feet by eight feet face, weighing forty tons without the shaft, intended to give 650 horse power. They have also a pair of 26x60 inch engines for one of the Fall River mills; one 30x72, 650 horse-power, for the Chelsea Rubber Company, Chelsea, Mass.; a 26x60 for the Darlington Cotton Mill, Darlington, S. C., and a number of smaller engines, running from sixteen inch up to twenty-six inch, for different purposes.

—— The Liverpool and Manchester line of the London and Northwestern Company, in the district where the passenger railway had its birth, has utilized electricity for lighting the carriages by means of "glow" or incandescent lamps of 20 candle-power each. The engine for working the dynamo-electric machine is on the tender behind the locomotive, and is supplied with steam from the boiler of the locomotive. The electric current passes from the generator through the train and then back to its source, where, fixed to the footplate, is a regulator fitted with an electric lamp showing the engineer the degree of light in the train. Each compartment in the train is provided with two glow lamps so arranged that if one of them is extinguished the other is lighted instantly.

# ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING SEPTEMBER 30, 1884.

305,737 Electrolytic liquid for secondary batteries; Willard E. Case, Auburn, N Y.

305,747 Electric alarm signal; Isaiah H. Farnham, Portland, Me.

305,812 Electric telephonic transmitter; William B. Hale, Washington, D. C., assignor to the Fuller Universal Telephone Company, New York, N. Y.

305,817 Incandescent electric lamp; George W. Hickman, Washington, D. C., and Joseph F. McCoy, Rahway, N. J., assignors to the Viaduct Manufacturing Company, of Baltimore, Md.

305,829 Apparatus for communicating telephonically; William N. Marcus, Philadelphia, Pa.

305,854 Electric cable; William A. Shaw, Pittsburgh, Pa.

305,894 Electro-therapeutic apparatus; Charles L. Clarke, Manchester, county of Lancaster, England, assignor to the Domestic Electrical Manufacturing Company, Boston, Mass.

305,901 Telephone transmitter; William S. Davis, Lowell, Mass., assignor of one-half to Jonathan Kendall and George M. Kendall, both of same place.

305,904 Conduit for underground conductors; Daniel H. Dorsett, Chicago, Ill.

305,906 Local circuit for telegraphs; B. E. J. Eils, Washington, D. C.

305,907 Quadruplex telegraph; B. E. J. Eils, Washington, D. C.

305,908 Art of biplex telegraphic transmission; B. E. J. Eils, Washington, D. C.

305,909 Quadruplex telegraph; B. E. J. Eils, Washington, D. C.

305,927 Telephone receiver; George M. Hopkins, Brooklyn, N. Y.

305,928 Telephone receiver; George M. Hopkins, Brooklyn, N. Y.

305,980 Telephone receiver; Theodore F. Taylor, Brooklyn, N. Y.

305,984 Combined gas and electric light fixture; S. B. H. Vance, New York, N. Y.

306,005 Electric lamp; Thomas L. Dennis, Newburyport, Mass., assignor to the Columbia Electric Light and Manufacturing Company, of New York, N. Y.

306,036 Telephone transmitter; Charles W. Long, Louisville, Ky.

306,087 Electric cable; Thomas G. Turner, New York, N. Y.

**PATENTS!** Thomas P. Simpson, Washington, D. C. No pay asked for patent until obtained. Write for inventor's guide.

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